A MULTI-METHOD EVALUATION OF POLICE USE OF FORCE OUTCOMES: FINAL REPORT TO THE NATIONAL INSTITUTE OF JUSTICE

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INTRODUCTION

This exploratory study was primarily concerned with the investigation of factors related to injuries that may occur to police officers and citizens during use of force events. Previous studies have shown that 1-2 percent of police-citizen contacts involve the threat or application of physical force by the police, while 15-20 percent of arrests may result in the use of force by police to control a resistant suspect. Most applications of force are low level, however, and involve the use of an officer's hands, arms, and body to push or pull against a suspect to gain control. Of course, not all force is minor and officers are trained and equipped to use a variety of force techniques and weapons to overcome resistance, including less lethal devices such as pepper spray, batons, or Tasers, as well as firearms to defend themselves or others against threats of death or serious bodily injury. Various legal and policy restrictions govern the use of force by police, beginning with the 4th Amendment's prohibition against unreasonable searches and seizures and devolving downward to state statutes and departmental policies that govern how and under what conditions officers may use force. In most law enforcement agencies today, the use of force is tightly controlled by policy, and more serious applications of force are reviewed and/or investigated by supervisory personnel or internal affairs units.

Whenever physical force is threatened or used the police, the possibility of injury arises to citizens and officers. Until recently, though, little research had been done on the frequency, causes, or correlates of force-related injuries. In the present study, injury rates to citizens when force was used ranged from 17 to 64 percent (depending upon the agency reporting), while injury rates among officers ranged between 10 and 20 percent. Although in many cases agency-supplied injury data did not allow for a detailed analysis of the nature or seriousness of the injuries reported, data from agencies such as the Miami-Dade County Police Department indicated that injuries were typically minor (bruises, strains, abrasions). Among the 414

suspects injured in the Miami-Dade data, 73 (18%) received injuries categorized as "major" (dog bites, punctures, broken bones, internal injuries, or gunshot wounds), while the remainder suffered minor injuries.

Regardless of their frequency or severity, though, all injuries must be taken seriously. When police in a democracy use force against a free citizenry and injury results, concern over police abuse arises, litigation often ensues, and public legitimacy is threatened. Practically speaking, injuries cost money, either in medical bills for indigent suspects, worker's compensation claims for injured officers, or compensatory damages paid out in legal settlements or judgments. Over the last 10-20 years, new technologies have emerged that offer the promise of more effective control over resistive suspects with fewer or less substantial injuries. Oleoresin capsicum (OC or pepper) spray was among the first of these "new" less lethal weapons to achieve widespread adoption by police forces, while more recently conducted electrical devices (CEDs) such as the Taser have gained popularity.

CEDs generally, and Tasers in particular, have proliferated in recent years. Industry estimates now place the Taser in the hands of more than 11,500 police agencies nationwide. Other sources offer different numbers but it is clear that thousands of agencies have purchased Tasers for their officers. As did pepper spray, Tasers have generated controversy and have been associated with in-custody deaths and allegations of overuse and even intentional abuse. Of key interest to policy-makers and law enforcement officials are questions of whether Tasers are safe and effective and where (if at all) they should be placed on force continua that attempt to match appropriate police force options with levels of suspect resistance.

Overview of Methods

Funded by the National Institute of Justice to the University of South Carolina in January 2006, this research project on police use of force set out to contribute to our understanding of how and why injuries occur to police and citizens during use of force events. Although much is known about how frequently and under what conditions police use force, comparatively little is

known about the causes and correlates of use of force-related injuries, and even less is known about the impact on injuries of emerging less lethal weapon technologies such as the Taser. In order to accomplish the project's main objective, several complementary research strategies were used. First, a nationally representative survey of U.S. law enforcement agencies was conducted to provide a snapshot of how less lethal force technologies, training, and policies are being used by state and local agencies. Second, agency-supplied use of force datasets from three agencies – Seattle, Washington, Miami-Dade, Florida, and Richland County, South Carolina – were analyzed separately in an effort to identify individual and situational predictors of injuries to officers and citizens during use of force events. Third, more than 24,000 use of force records from 12 police agencies were combined and analyzed using multilevel and fixed effects models to investigate the relationship between situational and policy-related factors and the likelihood of injury to police and citizens. Fourth, a longitudinal analysis was conducted that explored the effect on injury rates of the adoption of the Taser by the Austin, Texas and Orlando, Florida police departments. Finally, in effort to provide context to the quantitative analyses and gain insight into how use of force encounters unfold, in-depth interviews were conducted with more than 250 officers and 25 citizens who were involved in use of force events in two mid-size law enforcement agencies, one of which issued the Taser to its officers and one of which did not.

Organization of Report

This report is divided into eight chapters. Following this introduction, Chapter 2 presents an overview of the extant literature and what is currently known about how injuries occur in violent encounters between police and citizens. The methodology and results from each analytic component of the study are presented in Chapters 3-7. Chapter 3 discusses how the national survey was conducted and what was learned about less lethal technologies, policies, training, and use of force data collection mechanisms in U.S. law enforcement agencies. Chapter 4 presents the results from the three agency-level datasets that were analyzed (Seattle,

Miami-Dade, Richland County) and what incident-level variables influenced injury outcomes in those jurisdictions. In Chapter 5, we discuss the multiagency analysis that brought together more than 25,000 use of force records from 12 agencies and examined both policy-related and incident-level predictors of injuries. Chapter 6 presents the results from the longitudinal analysis of injury data in Orlando and Austin and discusses the effect that the decision to adopt the Taser had on officer and suspect injuries in the two cities. Chapter 7 reports on the findings from our interviews with officers and suspects involved in actual use of force encounters and what factors may have contributed to their injuries. Finally, Chapter 8 of the report discusses the implications of our findings for policy, training, and future research.

SECTION 2

LITERATURE ON POLICE USE OF FORCE AND INJURIES

The use of force by police has been the subject of empirical inquiry for more than 40 years. In that time, much has been learned about the nature and extent of the force used by police and the conditions and correlates that affect its application. Among the most important issues that have received attention from use-of-force researchers over the years are those involving injuries to officers and suspects. Almost half a century later, however, much of the research on injuries remains descriptive in nature or contains substantial data and analytic limitations that prevent the research from being used optimally to make policy or training decisions at the agency level. Furthermore, with the proliferation in recent years of conducted energy devices (CEDs) such as the Taser® and Stinger®, questions have arisen regarding the safety of such weapons and what their impact has been on injuries and in-custody deaths (Amnesty International, 2004). The lack of independent research on CEDs and injuries has left law enforcement agencies without the information they need to make sound policy decisions or to respond to inquiries from citizens, special interest groups, and policy-makers, some of whom question whether CEDs are an appropriate less-lethal alternative for general police use.

In the early to mid 1990s, police found themselves in a similar position with respect to oleoresin capsicum (OC) or pepper spray. In those days, OC was spreading rapidly among American police forces and concerns were being raised concerning its misuse and safety (Amnesty International, 1997). The National Institute of Justice funded a variety of studies on the safety and effectiveness of OC (Edwards, Granfield, & Onnen, 1997; Granfield, Onnen, & Petty, 1994; Petty, 2004), and several other researchers examined its incapacitative effects and the relationship between OC use and officer and suspect injuries (Kaminski, Edwards, &Johnson, 1998, 1999; Morabito & Doerner, 1997; Smith & Alpert, 2000; Lumb & Friday, 1997).

Illustrative of the limitations associated with most of the injury-related research from that era is Kaminski and Sorenson's 1995 study of 1,550 nonlethal assaults on police in Baltimore County, Maryland. They were primarily interested in identifying variables that predicted injuries to officers during violent police-citizen encounters. Using logistic regression, they examined the effects on injury of more than two dozen variables, including the type of force used by officers and the type of resistance offered by suspects. Their force and resistance variables, though, were simple binary measures that captured police use of force and suspect resistance as involving either (1) hands-on tactics or (2) weapons (gun/other weapon). The data did not allow for a more discerning analysis that would have accounted for the various levels of force and resistance reflected in a standard, linear use-of-force continuum, nor did their 1980s data contain any uses of CEDs.

Unfortunately, even more contemporary studies of police use of force and injuries have suffered from similar data limitations (Smith & Petrocelli, 2002). Moreover, although CEDs are now in use by more than 7,000 law enforcement agencies in the U.S (GAO, 2005),[1] the few epidemiological studies conducted on CEDs have been descriptive in nature and none examined the relationship between CEDs and injuries within the broader use-of-force context (Charlotte-Mecklenburg Police Department, 2006; Jenkinson, Neeson, & Bleetman, 2006; Seattle Police Department, 2002). Because many use-of-force encounters involve multiple types of force, it is critical to assess the *independent* contribution of CEDs to injury outcomes so as to avoid erroneous conclusions about cause and effect. The lone exception (discussed later) appears to be the study by Smith, Kaminski, Rojek, Alpert and Mathis (2007), which analyzed the relationship between CEDs and officer and suspect injuries while simultaneously controlling for the effects of other types of force used by officers as well as suspect resistance and other factors. Although the Smith et al. (2007) study was an improvement over previous research, it

[1] Industry figures place CEDs in the hands of more than 11,000 law enforcement agencies nationwide.

analyzed data from only two law enforcement agencies. Thus, there continues to be a need for additional studies on the use of force by police and officer and suspect injuries, especially as they relate to CEDs. The dearth of research to date has left law enforcement executives and other policy-makers with scant information on which to base critical decisions regarding policy, training, and equipment.

Use of Force and Injuries

While the empirical literature on police use of force has grown over the past four decades, limited attention within this body of work has focused on injuries sustained by suspects and officers during these encounters. The deadly force literature has examined the patterns and characteristics of police shootings and resulting fatalities, which represents analysis of the most extreme injury to suspects (e.g., Alpert & Dunham, 1995; Fridell & Binder, 1992; Fyfe, 1978; Geller, 1982; Scharf & Binder, 1983; Sparger & Giacopassi, 1992; White, 2002). In addition, other researchers have examined the patterns and characteristics of encounters that result in police deaths in the line of duty (Cardarelli, 1968; Fridell & Pate, 1997; Fridell & Pate, 2001; Fridell, et al., 2005; Kaminski, 2002, 2004; Kaminski, Jefferis & Chanhatasilpa, 2000; Kaminski & Marvell, 2002; King &Sanders, 1997; Quinet, Burdua, & Lassiter, 1997; Mencken, Nolan, & Berhanu, 2004). Less effort, however, has been directed at the examination of non-lethal injuries to suspects and officers. The following discussion provides a review of the existing empirical literature on injuries to officers and citizens resulting from use of force encounters.

Suspect injury

In general, injuries to suspects resulting from use-of-force incidents are infrequent relative to the overall number of police-citizen contacts. The 2002 National Survey of Contacts between the Police and the Public found that approximately 1.5 percent of citizens who had contact with the police reported that officers used or threatened to use force against them, with 14 percent of these respondents claiming they sustained an injury (Durose, Schmitt, & Langan,

2005). Similar low levels of suspect injuries sustained during use-of-force encounters have also been found in single agency analyses using surveys of law enforcement officers (Kaminski, DiGiovanni, & Downs, 2004; Smith & Petrocelli, 2002). Alternatively, studies using official agency records found somewhat higher rates of injuries to citizens during use-of-force encounters, generally around 40 percent (e.g., Alpert & Dunham, 2004; Henriquez, 1999).[2] Despite the differences in the reported rates of suspect injury, both officer surveys and agency reports have found that most injuries are relatively minor, typically consisting of consisting of bruises, abrasions, and muscle strains and sprains (Alpert & Dunham, 2000; Henriquez, 1999; Kaminski et al., 2004; Smith & Petrocelli, 2002).

A few studies moved beyond the general reporting on the frequency of suspect injuries to examine this likelihood relative to specific use-of-force tactics and weapons. Meyer's (1992) analysis of Los Angeles Police Department use-of-force reports revealed that the use of a flashlight resulted in moderate or major suspect injuries in 80 percent of incidents in which it was employed. Punching suspects resulted in major or moderate injuries 64 percent of the time, the use of a baton 61 percent, and other bodily force 46 percent. Interestingly, officer use of older generation CEDs and chemical irritants resulted in no major or moderate injuries to suspects or officers. A similar high likelihood of suspect injury was found in relation to physical force and the use of a baton in Alpert and Dunham's analysis of the Miami-Dade Police Department (Alpert and Dunham, 2000). Smith and Petrocelli (2002) also found that suspects were most likely to be injured when officers used bodily force. Cambell, Berk, and Fyfe (1998) found that police use of canines significantly increased the risk of suspect injury, particularly when suspects threatened or attacked the dog.

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[2] This disparity in injury rates can partially be attributed to the different research methodologies, as well as different police departments. Official police reports generally require that the officer's action meet a certain threshold before a report is submitted, such a control lock or tackle. Surveys, on the other hand, can capture lower levels of force like grabbing and holding. As a result, the surveys capture a much broader level of force incidents, thereby increasing the denominator used to calculate the injury rate.

Officer injury

The analysis of injuries to officers in use-of-force encounters has provided mixed results with regard to frequency of occurrence. Several studies found that about 10 percent of officers were injured during use-of-force incidents (Henriquez, 1999; Kaminski et al., 2004; Smith & Petrocelli, 2002). However, analysis of data from Miami-Dade Police Department and the Baltimore County (Maryland) Police Department revealed substantially higher rates of officer injury, 38 and 25 percent, respectively (Alpert & Dunham, 2000; 2004; Kaminski, & Sorensen, 1995). Interestingly, the above agencies that had lower levels of officer injury allowed their officers to use OC spray, whereas the two agencies with higher injury rates did not authorize OC. Studies of assaults on police also found relatively high injury rates, which ranged from about 25 to 50 percent (Hirschel, Dean & Lumb, 1994; Kaminski & Sorensen, 1995; Uchida, Brooks & Koper, 1987; Federal Bureau of Investigation, 2006). Similar to findings regarding suspect injuries, research on force-related officer injuries found that most also were relatively minor (Alpert & Dunham, 2000; Brandl, 1996; Brandl & Stroshine, 2003; Kaminski et al., 2004; Smith & Petrocelli, 2002).

A few researchers have examined the likelihood of officer injury relative to the type of force used by officers. Alpert and Dunham's (2000) analysis of official use of force records in Miami-Dade found that the greatest likelihood of officer injury occurred when officers attempted to subdue a suspect with bodily force (punching, kicking, take-downs, wrestling, and joint locks), which accounted for 69 percent of injuries. Similar results were found in the analysis of other agencies, regardless of whether official use-of-force reports or officer surveys were utilized (Meyer, 1992; Smith & Petrocelli, 2002), however one study found that officers were less likely to be injured when they used bodily force versus a gun or other weapon, though the effect was statistically significant only at the .10 level (Kaminski & Sorensen, 1995). Overall, the empirical

evidence suggests that getting close to suspects to use hands-on tactics increases the likelihood of officers sustaining injuries.

In summary, the extant research suggests that a relatively small proportion of use-of-force encounters result in injuries to suspects and officers. However, when official records were examined suspect injuries were higher, which may be attributable to reporting thresholds that result in the elimination of incidents where minor force is applied. The injuries sustained by suspects and officers tend to be minor or moderate in nature, with only a handful representing broken bones or gunshot wounds. That most injuries are minor by no means diminishes the fact that suspects and officers are still being harmed, and measures should be taken to reduce them. Research also suggests that suspects have a higher likelihood of injury when officers use canines, bodily force, and impact weapons (such as batons or flashlights), and officers are more likely to sustain injury when they use bodily force. The implications of this last pattern suggest the need for agencies to consider alternatives to officer use of hands-on tactics and impact weapons if they wish to reduce injuries, which as the above discussion on the frequency of officer injury suggests may be found in less-lethal weapons such as OC and CEDs.

The Impact of Less-Lethal Weapons on Injuries

For more than 30 years the law enforcement community has been on a quest to find less lethal weapons that would provide officers with the ability to effectively manage use-of-force incidents while at the same time reducing the potential for injury to suspects and officers. Although this interest has prompted the development of numerous devices, we limit our focus to OC and newer generation CEDs. These two devices have received the greatest level of deployment among patrol offices nationwide, and therefore have the most potential for impacting the frequency of suspect and officer injuries.

OC spray

OC spray was developed with the intent of providing a quicker and more effective means for safely incapacitating suspects than traditional chemical agents used by law enforcement,

such as chloroacetophenone (CN) and o-chlorobenzyildene malonoitrile (CS) (Chan et al., 2001). OC spray was rapidly adopted by law enforcement agencies across the United States through the late 1980s and early 1990s, but this diffusion was not without controversy. Notably, the American Civil Liberties Union (ACLU) of Southern California had made the accusation that OC spray was causing the death of individuals in police custody (ACLU, 1995). This concern ultimately prompted the National Institute of Justice (NIJ) to fund research on the link between OC spray and in-custody fatalities, which found that the deaths occurring post OC spray use were exclusively or largely the result of positional asphyxia, pre-existing health conditions, or drug-related factors (Granfield, Onmen, & Petty, 1994; Petty, 2004). A handful of research efforts subsequently followed that directly or indirectly examined the impact of OC spray on non-lethal injuries to suspect and officers.

Several studies found that the adoption of OC by departments led to substantial reductions in assaults on officers and declines officer and suspect injury rates, that OC use was associated with low rates of both officer and suspect injury (around 10% and in some cases no officer injuries), and that injuries were almost always minor (Edwards, Granfield, & Onnen, 1997; Gauvin, 1995; Kaminski et al., 1999; Lumb & Friday, 1997; National Institute of Justice, 2003; Nowicki, 1993; Smith & Petrocelli, 2002). Moreover, Morabito and Doerner (1997) examined the injury rate related to OC spray as the Tallahassee Police Department transitioned its use from a level equivalent to impact weapons to one equivalent to hand-on tactics (punches, kicks, and pain compliance techniques) and found that OC spray-related injuries remained low at both levels. This finding is important in light of the findings above indicating that officer use of impact weapons and hand-on tactics was associated with higher levels of suspect injury. It suggests that OC spray provides an alternative for reducing such injuries.

A limitation to the findings on OC spray, however, is that they are largely descriptive in nature with analyses that rely primarily on simple frequencies of injuries relative to OC use. These studies did not employ methodologies that controlled for the level of suspect resistance

and other specific use-of-force tactics that may have been used in conjunction with OC in any given use-of-force encounter. As a result, we do not know the independent effect of OC spray on suspect and officer injuries after holding constant other types of force and resistance that may have been used.

Conducted energy devices

Epidemiological studies have primarily examined the relationship between CEDs and nonfatal injuries, probably because CED-associated deaths are statistically rare events. Several early studies of injury rates pre- and post-CED adoption were conducted by law enforcement agencies themselves. For example, the Austin, Cape Coral, Charlotte-Mecklenburg, Cincinnati, Phoenix, South Bend, and Topeka police departments and the Orange County Sheriff's Office all reported substantial declines in either officer or suspect injury rates following the adoption of CEDs. Reductions in suspect injuries ranged between 40 and 79 percent, while reductions in officer injuries ranged between 3 and 93 percent (Charlotte-Mecklenburg Police Department, 2006; Hougland, Mesloh, & Henych, 2005; Jenkinson, Neeson, & Bleetman, 2006). These findings, however, are not the product of research produced by independent sources, which has been a point of contention for Amnesty International and the ACLU (Amnesty International, 2004, 2006; ACLU of Northern California, 2005). Further, as with much of the research on the effects of the adoption of OC spray in the 1990s (Kaminski et al., 1998), these simple "before and after" analyses suffer from a number of threats to internal validity. Moreover, these analyses did not measure the effect of CEDs on injury risk controlling for situational factors and other types of force used in conjunction with CEDs during any given force incident.

One peer-reviewed study did find a low level of injury associated with CED use (7.8%) compared to the use of CS spray (12.6%) and batons (23.7%), but the data used in the analysis were in part from a database maintained by TASER International (Jenkinson, Neeson, & Bleetman, 2006). Smith et al. (2007) received data from two law enforcement agencies (Richland County, South Carolina Sheriff's Office and Miami-Dade, Florida Police Department)

and used multiple regression to analyze the relationship between CEDs and officer and suspect injuries controlling for the effects of other types of force used by officers, suspect resistance, and other factors. The results showed no statistically significant relationship between CED use and the odds of deputy or suspect injury in the Richland County (SC) Sheriff's Department (RCSD), which had recently adopted CEDs and had long authorized the use OC spray for its deputies. Regarding other types of force, the study found that deputy use of soft empty hand tactics (joint locks, holding, pushing, etc.) was associated with increased risk of deputy injury, while hard hand tactics (e.g., punching, kicking) were associated with increased risk of suspect injury. The use of OC was associated with reduced risk of suspect injury (but not deputy injury), while use of a canine was associated with increased risk of suspect injury.

In the Miami Dade Police Department (MDPD), which has long authorized the use of CEDs but had not authorized the use of OC for officers, CED use was significantly associated with decreased risk of injury among both officers and suspects. Other findings were that canines and officer use of soft hand and hard hand tactics were associated with increased risk of suspect injury and decreased risk of officer injury. This study also employed a measure of the severity of suspect injury in the MDPD, classified as none, minor (bruises/abrasions, sprains/strains, lacerations), and major (bites, punctures, bone fractures, internal injuries, gunshot wounds). Findings showed that CED exposure was associated with reductions in the severity of suspect injuries, while officer use of soft and hard hands and canines were associated with increases in the severity of suspect injuries (There were too few injured officers for a severity-of-injury analysis for that group).

Medical Research on CEDs

In addition to the epidemiological studies of CEDs conducted to date, medical researchers also have begun examining in controlled settings the physiological effects of CEDs on animals and humans. Moreover, given the focus of the current study on CEDs and their impact on injuries, it is important to consider the findings from the medical research in

completing our review of the literature. This emerging body of research likely will have bearing on the interpretation of our quantitative and qualitative analyses and on the policy, training, and research recommendations that follow.

Controlled animal trials

One of the critical concerns regarding the use of CEDs is whether or not exposure can induce ventricular fibrillation (VF). To help answer this question, several controlled studies using sedated animals (dogs or pigs) have been conducted (Dennis, Valentino, Walter, Nagy, Winners, Bokhari, Wiley, Joseph, & Roberts, 2007; Esquivel, Dawe, Sala-Mercado, Hammon & Bir, 2007; Ho, Miner, Lakkireddy, Bultman & Heegaard, 2006; Lakkireddy, Wallick, Verma, Ryschon, Kowalewski, Wazni, Butany, Martin, & Tchou, 2008; McDaniel, Stratbucker, Nerheim, & Brewer, 2005; Nanthakumar, Billingsley, Masse, Dorian, Cameron, Chauhan, Downar, & Sevaptsidis, 2006; Roy & Podgorski, 1989; Stratbucker, Roeder & Nerheim, 2003; Walter, Dennis, Valentina, Margeta, Nagy, Bokhari, Wiley, Joseph, & Roberts, 2008). These studies found no VF of the heart using standard discharges of relatively short duration (e.g., 5-15 seconds). However, higher output discharges (e.g., 15-20 times the standard) or discharges of longer duration (two 40 second exposures) induced VF or increased heart rhythm (ventricular tachycardia) in some pigs (Dennis et al.2007; Lakkireddy et al., 2008; Stratbucker et al., 2003; McDaniel et al., 2005; Walter et al., 2008), and longer duration exposures led to VF induced death in three pigs (Dennis et al, 2007; Walter et al., 2008).

Research by Nanthakumar and colleagues (2006) found that orienting TASER barbs across the hearts of pigs (simulating a “worst case scenario” of creating a current vector that directly passes through the heart) led to stimulation of the heart muscle (but not VF), while placement across the abdomen did not (see also Lakkireddy et al., 2006; Roy & Podgorski, 1989). Although cardiac stimulation may be of little concern for healthy subjects, Nanthakumar et al. (2008) caution that heart stimulation might induce VF if preexisting conditions are present, such as heart disease, drug intoxication, excited delirium, and so forth. Interestingly, research

by Lakkireddy et al. (2008) in which five pigs were shocked with a device designed to replicate a TASER X-26 before and after infusions of cocaine suggests that the drug may be protective for CED-related VF risk. Of course, how cocaine intoxication may interact with other risk factors such as heart disease during CED exposure is unknown, not to mention the risks associated with other types of drugs (e.g., PCP, methamphetamine).

Controlled human trials

Several controlled studies using healthy human subjects also have been conducted (Dawes, Ho, Johnson, Lundin, Janchar & Miner, 2008; Dawes, Ho, & Miner, 2008; Dawes, Ho, Johnson, Lundin, & Miner, 2007a, 2007b; Ho, Dawes, Bultman, Thacker, Skinner, Bahr, Johnson, & Miner, 2007; Ho, Miner, Lakireddy, Bultman, & Heegaard, 2006; Ho, Dawes, Reardon, Lapine, & Miner, 2008; Levine, Sloane, Chan, Dunford & Vilke, 2007; Levine, Sloane, Chan, Dunford, & Vilke, 2005; Vilke, Sloane, Bouton, Kolkhorst, Levine, Neuman, Castillo, & Chan, 2007; Sloane, Chan, Levine, Dunford, Neuman, & Vilke; 2008). Levine et al. (2007) monitored the hearts of 105 police trainees before, during and after exposure to the X-26 TASER for approximately 1 to 5 seconds (average = 3 seconds). Although subjects experienced significant increases in heart rate following exposure, none experienced VF. An earlier study by Levine et al. (2005) reached similar conclusions. Ho et al. (2008) monitored the hearts of 18 volunteer human subjects during a 20 second exposure from TASER's new wireless extended Range Electronic Projectile (XREP). Again, higher heart rates were observed, but there was no VF.

Research by Ho et al. (2007) examined the effects of either a 15-second sustained exposure or intermittent three 5-second exposures to an X-26 TASER (randomly assigned) on respiratory function among 52 law enforcement volunteers. The researchers were unable to detect any respiratory impairment during either the 15-second exposure or the three 5-second intermittent exposures. Other research supports these findings (Dawes et al., 2007a; 2008), including tests of a 15 to 20 second exposure from the XREP (Dawes et al., 2007b).

To emulate more closely field conditions during exposure to CEDs, several recent studies induced physiologic stress among subjects. Vilke et al. (2007) exposed eight subjects to a 5-second shock from an X-26 TASER following rigorous exercise. Blood pressure and cardiac function were monitored up to 60 minutes post exposure. No clinically significant or lasting changes in cardiovascular levels were found. Ho, Johnson, and Dawes (2007) and colleagues simulated physiologic states in volunteer human subjects, including acidosis, exercise induced exhaustion, and alcohol intoxication. According to Ho et al. (2007), TASER exposure had no significant negative impacts on blood acidosis levels, respiration, or cardiac function.

Several other studies evaluated the effects of TASER exposures of up to 20-seconds on blood chemistry (Dawes et al., 2007a, 2007b; Ho et al., 2006; Sloane et al., 2008; Vilke et al., 2007) and core body temperature (Dawes et al., 2008 Dawes et al., 2007a). These studies generally found no adverse effects.

While the above review suggests CEDs are relatively safe when used on healthy at-rest and physiologically stressed subjects, medical researchers caution that CEDs are not risk free (National Institute of Justice, 2008; Vilke & Chan, 2007). Strote & Hutson (2008), for example, point out that CEDs may cause physiologic and metabolic changes that are clinically insignificant in healthy individuals but that could be harmful or even life-threatening in at-risk populations (e.g., obese subjects with heart disease and/or intoxicated on drugs who struggle with police). Additional concerns have been raised regarding secondary injuries and deaths associated with CED exposure. For instance, there have been at least six deaths due to head injuries suffered during falls following CED exposure (Kroll, Calkins, Luceri, Graham, & Heegaard, 2008a).

Case reviews

Two mortality case review studies of autopsy and toxicology reports of deaths proximate to the use of CEDs have been conducted, and a third study is in progress. An additional case

review study of nonfatal injuries subsequent to CED exposure was conducted by Bozeman, Winslow, Hauda, Graham, Martin, & Heck (2008).

Kornblum and Reddy (1991) examined 16 CED-related deaths and reported that in all cases the subjects were behaving in a bizarre or unusual manner and that13 were under the influence of drugs (cocaine, PCP or amphetamine). According to their analysis, death was caused by drug overdoses in 11 cases (68.8%), gunshot wounds in three, an undetermined cause in one, and heart disease plus CED shock on one case. They concluded that the CEDs in and of themselves did not cause death, though a CED exposure may have contributed to one death (Note, however, that in addition to heart disease, this subject had lethal levels of PCP in his system).

In a review of 37 CED-related deaths, Strote and Hutson (2006) found that autopsy reports indicated 20 (54.1%) of the subjects had cardiovascular disease, 29 (78.4%) were under the influence of illegal drugs (primarily stimulants), 28 (75.7%) were given a diagnoses of excited delirium, and 29 (78.4%) of the subjects were restrained by police in some manner. Medical examiners reported CEDs were a possible cause of death in six cases (16.2%) and were a contributory cause in four (10.8%). The authors concluded that a common factor in the deaths was extreme agitation, often accompanied by stimulant drug use and/or preexisting heart disease. Importantly, they note that fatal encounters in which CEDs are used involve subjects already at risk for sudden death from other causes.

Bozeman and colleagues are conducting a study to determine whether or not CEDs contribute to or cause death (National Institute of Justice, 2008). Though their interim report provides few details, they conclude that there is no conclusive medical evidence that indicates a high risk of death from the direct effects of CEDs. They do caution, however, that CEDs are not risk free, and further, that they can produce secondary or indirect effects that may result in death, such as shocking a subject in water leading to drowning or falls. Further, their preliminary review of deaths following CED exposure found that many were associated with continuous or

repeated exposure. Consequently, they urged caution in the use of multiple exposures to CED discharges when subduing resistive or combative individuals. They also noted that established CED safety margins for healthy adults may not apply to small children, persons with diseased hearts, the elderly, women who are pregnant and other at-risk individuals.

Bozeman et al. (2008) reviewed police and medical records of all suspects exposed to a CED shock across six law enforcement agencies over a two-year period. Injuries were classified as mild (abrasions, contusion, minor lacerations), moderate (bone fractures, major lacerations) or severe (major head injury, loss of limb or eye, VF). Of 962 subjects, 743 (77.2%) received no injuries, 216 (22.5%) received mild injuries, 2 (0.2%) received moderate injuries, and 1 (0.1%) received severe injuries. In all, 99.7 percent of the suspects were not injured or mildly injured, while 0.3 percent were moderately or severely injured following CED exposure. The authors conclude that significant injuries associated with CED use are rare.

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SECTION 3

THE NATIONAL SURVEY

The Police Executive Research Forum conducted a survey of a stratified, random sample of approximately 1,000 municipal, county and state law enforcement agencies to achieve two objectives: (1) provide comprehensive, national information about the deployment of, policies for, and training with less lethal technologies; and (2) provide information for use in other components of the project designed to measure the impact of organizational and incident-level variables on force outcomes. The survey solicited information from each agency on the following topics related to the use of less lethal force:

- Types of less lethal technologies deployed and information regarding that deployment (e.g., for each technology, whether deployment is full or partial and the dates of deployment)
- Academy and in-service training provided to officers/deputies for various types of force/weapons
- Policies regarding the use of each technology (i.e., placement of the technology on a standard, linear force continuum; special limitations placed on the use of the technology)
- Policies regarding force reporting and review
- The nature and quality of departmental records/data regarding use of force incidents including outcomes (e.g., officer injuries, subject injuries).

Survey Methodology

Survey instrument

The University of South Florida spearheaded survey development in collaboration with the Police Executive Research Forum (PERF), the University of South Carolina, and law enforcement officials in the Tampa and Washington, D.C. areas.

As part of the process of developing and piloting the survey, three focus groups comprised of law enforcement practitioners were convened.[3] The participants at the first focus group generated a list of issues pertaining to weapons deployment, policies, use-of-force continuums/models, training, reporting, and review. After the list was developed, the group

[3] A list of attendees is included in Appendix A.

discussed challenges related to measuring these issues using survey methodology. Following the first focus group, a draft of the instrument was created, and the next two focus groups—held in Washington, D.C.—were used to refine and pilot the survey. At the second focus group, the participants were asked to comment and provide feedback on the draft survey. Key objectives were to ensure that major substantive topics were addressed and questions were clearly worded. Following the second focus group, the survey instrument was further refined. The survey was then sent to a group of agencies in the Washington, D.C. area for review. Law enforcement agency personnel were asked to complete the survey and attend the third focus group meeting. This meeting began with a general discussion concerning who should fill out the survey within the target agencies and the participants' general impressions of the survey. The participants were asked about their understanding of each question, the meaning of specific words and phrases, the types of information respondents needed to answer the questions, and the respondents' ability to match their answers to the response categories provided in the survey. After the third focus group, the survey was finalized and disseminated. A copy of the final survey instrument is included in Appendix B.

Sampling

The research team used the services of Tailored Statistical Solutions, LLC (TSS)—a recognized expert in statistical sampling—to draw a nationally representative sample of law enforcement agencies (LEAs) using the 2005 National Directory of Law Enforcement Agencies (NDLEA) database. This database listed information for 16,072 identified law enforcement agencies in the U.S. The directory contained the name and address of the chief executive of the agency and indicated for each the population served the agency type (e.g., municipal, county, state), the number of officers, and the region in which it is located.

Stratification

For purposes of sampling, TSS was asked to stratify the agencies by type of LEA, region, and the size of the population served. With regard to agency type, LEAs were categorized as State Police, Police Departments, or Sheriffs Offices. The State Police category was comprised of 50 LEAs listed as State Police and Highway Patrols in the NDLEA database.[4] The Police Departments included 12,906 Municipal Police Departments and 43 County Police Departments. The final category, Sheriffs Offices, was comprised of 30 Independent City Sheriff Offices and 3,047 County Sheriff Offices.

U.S. Census categories were used to designate four regions. The map in Appendix C illustrates the four regions of the United States (along with their nine subdivisions) as established by the U.S. Census Bureau.[5] A list in Appendix C categorizes all 50 states and Washington, D.C., into those regions.

The research team developed seven categories of agencies denoting population served; they are

- Under 10,000;
- 10,000 to 49,999;
- 50,000 to 99,999;
- 100,000 to 499,999;
- 500,000 to 749,999;
- 750,000 to 999,999; and
- 1,000,000 or more.

As indicated in Appendix D, the NDLEA data base did not provide information on population served for 795 agencies. This group of agencies became their own “Missing (population)” strata for purposes of sampling.

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[4] The Hawaii County Police Department serves as the state police agency for the state of Hawaii and was included in the frame and sample in this capacity.
[5] The Uniform Crime Reporting (UCR) Program uses this geographic organization when compiling the national crime data.

Sample size and selection

The objective was to select 1,000 agencies from the stratified target population to receive surveys. Appendix D presents the strata that were used for sample selection and the number of available agencies within each. Two groups were pre-designated to be included with certainty. All state police agencies were included (n = 50), as were all LEAs serving 500,000 or more populations (n = 141). The agencies within the only stratum that contained fewer than 20 LEAs was also included with certainty; this group was comprised of the six Sheriff Offices in the Northeast region serving populations of less than 10,000.

The remainder of the sample (n = 803) was selected from the LEAs within the 35 other stratified groups. Given the target sample size and number of strata, we needed 22.9 LEAs per stratum. To accommodate the numbers, where possible, the goal was to select 23 agencies from each stratum that contained at least 100 agencies in the population and 22 agencies from each stratum that contained fewer than 100 LEAs.[6] [7]

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[6] Steps were taken during sampling to reduce "survey overload" on agencies. This was required because another NIJ study (Terrill et al.) involved a national survey of law enforcement agencies on similar topics close in time to the dissemination of the current survey. Similarly, PERF was sending out a national survey on another topic (hereafter called the "CRISP" study). There were three groups in the database: (1) LEAs selected by Terrill; (2) LEAs selected into the CRISP sample; and (3) LEAs not selected for either of the previous two studies. Within each stratum, group 3 was compared to groups 1 and 2 to determine whether statistically significant differences existed for nonstratification variables (e.g. number of officers). Since no significant differences existed, we attempted to minimize the survey burden on the LEAs. When group 3 was sufficiently large (at least 23 LEAs in the stratum), then only that group was sampled. If the size of group 3 was not large enough (less than 23 LEAs in the stratum), then all of group 3 was included in the UOF sample and augmented with a random sample from groups 1 and 2. Where possible, we avoided including LEAs previously selected for both studies. Utilizing this technique yielded a modified 2-stage cluster sample.

[7] A stratification placement error was discovered following sample selection. One police department in the West region that had missing data for population served had been incorrectly placed in the 100,000 to 499,999 category. After the sample was finalized and the error discovered, that agency was moved to the proper stratum. The result is that the strata for police departments in the West region serving populations of 100,000 to 499,999 contains only 21 LEAs; the strata for police departments in the West region with missing population data contains 23 LEAs.

One thousand agencies were selected using the processes described above. However, prior to survey distribution, the research team determined that fifty of those agencies were either duplicates of others in the sample, were no longer in existence, and/or were not of the appropriate agency type to participate in this survey.[8] These were removed from the sample, producing a final sample size of 950.

Data collection

The 950 surveys were initially mailed on July 13, 2006. A follow-up mailing was sent to non-respondents three weeks later. Finally, a series of reminder letters was sent to the agencies that had not responded to any of the previous mailings. The first reminder was sent out on September 12, 2006; there were 2 subsequent reminders that were sent to non-respondents approximately three and six weeks later.

Of the 950 agencies in the sample, 518 agencies completed the survey resulting in a 54.5 percent response rate. Respondents were able to submit the survey via mail, facsimile, email, Federal Express, or the Internet. Of the 518 surveys received, 281 (54.2%) were sent via regular mail, 189 (36.5%) via the Internet, 41 (7.9%) by facsimile, six (1.2%) by email, and one (0.2%) by Federal Express.

Data weights

A weighting process was required so that we could provide a composite picture of law enforcement practices nationwide. The data were weighted to account for the fact that (1) agencies across the various strata had different probabilities of selection, and (2) the strata produced variable response rates. Weights for each strata were produced by determining the extent to which the population of agencies in each stratum were represented by survey respondents in that strata. Appendix E shows the following for each stratum: (1) the number of agencies in that stratum nationwide (Column A), (2) the percentage representation of these

[8] Of the fifty agencies removed, five were duplicate entries, 44 were deemed out of scope, and one is not currently active.

agencies among all U.S. law enforcement agencies (n=16,027) (Column B), (3) the number of agencies among the survey respondents (Column C), and (4) the percentage representation of these agencies among survey respondents (n=518) (Column D). The weights used in the analysis (Column E) were produced by dividing Column B by Column D.

Survey Results

In this section, we present frequencies for the survey responses; these frequencies are weighted to provide information that represents the population of agencies in the United States.[9]

Weapons deployment

The survey solicited information about less lethal weapon deployment around the nation. Agencies were presented with a list of weapons and asked to indicate for each what percentage of their "uniformed patrol officers/deputies and supervisors assigned to respond to calls for service" carry them "routinely." Response options were "Not Applicable" (if the weapon was not deployed by that agency to the specified population), "Less than 50%," and "50% or Greater." Agencies indicated whether "most" of those personnel carrying the weapon carried them "on their person" or "in their vehicles." Finally, for each weapon, agencies indicated whether the department had the weapon in use in the year 2000.

As indicated in Table 3-1, expandable batons and personal issue (i.e., hand held) chemical agents such as OC spray are the less-lethal weapons most utilized by the responding agencies. Over 85 percent (85.6%) of the agencies deploy the expandable baton; 38.5 percent deploy the straight or side-handle baton. Ninety-six percent (96.1%) of the responding agencies deploy either a straight or expandable baton; 44.9 percent of the agencies deploy both types. Virtually all agencies (99.4%) deploy handheld chemical agents. Just under half (47.1%) of the agencies deploy a Conducted Energy Device (CED), such as the Taser. Most of these agencies (93.8%) adopted these weapons after 2000.

[9] Survey data that were collected only for purposes of selecting agencies for other research components are not summarized here.

At least three-fourths of the agencies that deploy the expandable baton (76.4%), the CED (76.4%), or personal issue chemical agents (97.1%), deploy these weapons to at least half of their uniformed patrol officers/deputies and supervisors assigned to respond to calls for service. Expandable batons (93.9%), CEDs (91.9%) and personal issue chemical agents (94.3%) are generally carried on the person as opposed to in the vehicle.

TABLE 3-1 Less Lethal Weapon Deployment

Less lethal weapon	Weapon carried by officers/ deputies or Super-visors	If carried by uniform patrol officers/deputies or supervisors assigned to respond to calls for service				Dept. had this weapon in use in the year 2000
		Less than 50% of officers carry	50% or more of officers carry	Most carry this weapon on their person	Most carry this weapon in their vehicles	
Straight or side-handle baton	38.5%	60.9%	39.1%	35.5%	64.5%	37.2%
Expandable baton (e.g., Asp)	85.6	23.5	76.4	93.9	6.1	61.3
CED (Taser, etc.)	47.1	23.6	76.4	91.9	8.1	6.2
Personal issue chemical agents (e.g., OC spray)	99.4	2.9	97.1	94.3	5.7	82.8
Weapon-deployed chemical agent (e.g., pepper ball)	14.9	90.3	9.7	4.7	95.3	5.8
Other impact munitions	31.0	73.1	26.9	0.8	99.2	12.8

Force policies

Because anecdotal information indicates a movement away from the use of the traditional linear continuum or model, the survey solicited information regarding agency use of continuums/models and whether the agency had changed or was in the process of changing its practice in this regard. Nine of 10 (87.9%) agencies report the use of a force continuum/model in policy or training. A survey item requested that agencies indicate which of the following best

characterized their continuum or model: linear, matrix, circular, other. We report these data, but with the strong caveat that agencies appeared to interpret these terms differently.[10] Of those agencies that report a continuum/model, just over half (51.9%) described it as "linear." Agencies described their continuum/models as "matrix," "circular," or "other" in the following percentages, respectively: 23.8 percent, 18.5 percent and 4.9 percent. Examples of the descriptions provided for those who indicated an "other" model include reports of a mixed linear and circular model, a model whereby an officer's actions are one step beyond the subject's aggression, and a "pyramid" where the lowest threats were at the bottom building up to lethal threats at the top.

To assess the level of flux pertaining to this issue, agencies selected among the following statements:

- Our use of a continuum/model or type used has changed in the last two years.
- We are in the process of reconsidering our use of the continuum/model and/or the type used.
- Our agency has not changed in the last two years and is not now considering change.

One-third of the agencies indicated that they had changed or were in the process of changing their use of a continuum/model. Twenty-one (21.0) percent and 14.9 percent, respectively, indicated change had occurred or was being contemplated.

A critically important aspect of force policy is the delineation of the circumstances in which the various types of force can be used. As above, some agencies do not use linear continuums; those that do have varied categories and labels/definitions. These facts required that the team be innovative in attempting to measure variation across the nation in terms of force policy. A question with multiple scenarios solicited information regarding authorized use

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[10] In addition to asking agencies to characterize their model, we requested that they submit their models/continua with their surveys. A comparison of the models we received with survey responses indicated the differential interpretation of the terms.

of various types of less lethal force. The scenario question described five incidents involving the same officer and subject and, for each, asked whether six different types of force would be authorized in the situation. All scenarios were based on this background information:

> The following scenarios take place during a traffic stop for a minor moving violation during daylight hours. After stopping the vehicle and conducting a routine warrant check on the driver, the officer learns that the driver is wanted on a warrant for a misdemeanor-level, criminal domestic offense. The suspect is a 25 year-old male who is 5'9" tall and weighs 160 lbs. He is of average strength and fitness and has never been arrested before. The officer seeking to make the arrest is also a male and is of similar size, age, and fitness. When the following arrest scenarios take place, the suspect is standing next to his car, and the officer is by himself. Back up is responding but is 10 minutes away and no other citizens are present at the scene.

The five scenarios (A through E) varied with regard to the level of subject resistance. Thus, for instance, Scenario A reads as follows: "When told by the officer that he is under arrest, the suspect sits down on the ground, hands clearly visible. He silently refuses repeated commands to get up or to place his hands behind his back. His only statement to the officer is 'I don't want to go to jail.'" For each of the scenarios, agencies were asked to indicate for six types of less-lethal force, whether or not the officer would be authorized under the department's policy or training standards to use that force as an initial response to the suspect's actions. The six types of force listed for each scenario were:

- Soft empty-hand tactics/control
- Hard empty-hand tactics/strikes/punches
- OC spray, foam, or other chemical weapons
- Baton (collapsible, straight, side handle, etc.)
- CED in probe mode
- CED in drive stun mode

Respondents were directed to mark "no policy" if neither policy nor training covered the use of force type in the scenario and to mark "force option not utilized" if that was the case. The results provided below are for the agencies that use the type of force referenced and have a policy guiding its use.

Regarding Scenario A, virtually all agencies (99.8%) authorize the officer's use of soft empty-hand tactics/control against this subject who refuses, without physical force, to comply with commands. Forty-five percent (44.9%) authorize chemical spray, 29.6 percent authorize CEDs in drive stun mode, and 20.1 percent authorize CEDs in probe mode (see Table 3-2).

TABLE 3-2 Less Lethal Force Authorized for Use in Scenario A

Less-lethal force	Less Lethal Force Authorized?	
	Yes	No
Soft empty-hand tactics/control	99.8%	.2%
Hard empty-hand tactics/strikes/punches	9.5	90.5
OC spray, foam, or other chemical weapons	44.9	55.1
Baton (collapsible, straight, side handle, etc.)	9.4	90.6
CED in probe mode	20.1	79.9
CED in drive stun mode	29.6	70.4

Scenario B reads as follows: "When told by the officer that he is under arrest, the suspect initially cooperates, but when the officer grasps his wrists to guide his hands behind his back, he tenses his arms and refuses to comply with the officer's orders to stop resisting. He continues to tense and pull against the officer for 15-20 seconds." For the subject that tenses and pulls against the officer, virtually all agencies (98.0%) authorize the use of soft empty-hand tactics/control. Four in five agencies (82.4%) authorize the use of chemical agents and two-thirds (68.5%) authorize hard empty-hand tactics/strikes/punches. Just under 60 percent (58.7%) of the agencies (that deploy CEDS and have a policy guiding its use) allow the CED to be used in probe mode in this circumstance; 65.2 percent allow for the use of a CED in drive stun mode (see Table 3-3).

TABLE 3-3 Less Lethal Force Authorized for Use in Scenario B

Less-lethal force	Less Lethal Force Authorized?	
	Yes	No
Soft empty-hand tactics/control	98.0	2.0
Hard empty-hand tactics/strikes/punches	68.5	31.5
OC spray, foam, or other chemical weapons	82.4	17.6
Baton (collapsible, straight, side handle, etc.)	28.3	71.7
CED in probe mode	58.7	41.3
CED in drive stun mode	65.2	34.8

Scenario C reads as follows: "When told by the officer that he is under arrest, the suspect immediately turns and starts to run away. The officer begins to chase him and quickly closes the gap between himself and the suspect. When the officer and suspect are 12 feet apart, the suspect slows down and looks over his shoulder, but does not stop running." Less than half of the agencies (44.1%) allowed officers to use a baton against this fleeing suspect; strong majorities allowed for the use of soft empty-hand tactics/control (92.5%), hard empty-hand tactics/strikes/punches (71.1%) and chemical weapons (85.0%). Three fourths of the agencies (73.8%) allowed CEDs to be used in probe mode in these circumstances, and 68.8 percent allowed for the use of CEDs in drive stun mode (see Table 3-4).

TABLE 3-4 Less Lethal Force Authorized for Use in Scenario C

Less-lethal force	Less Lethal Force Authorized?	
	Yes	No
Soft empty-hand tactics/control	92.5%	7.5%
Hard empty-hand tactics/strikes/punches	71.1	28.9
OC spray, foam, or other chemical weapons	85.0	15.0
Baton (collapsible, straight, side handle, etc.)	44.1	55.9
CED in probe mode	73.8	26.2
CED in drive stun mode	68.8	31.2

Scenario D reads as follows: *"*When told by the officer that he is under arrest, the suspect states 'I'm not going to jail' and faces off against the officer with his hands raised in a "boxer's stance." All of the less lethal force options listed were authorized for use against this level of resistance by at least 85 percent of the agencies. For instance, 94.8 percent of the agencies allowed for CED use in probe mode and 89.8 percent allowed for CED use in drive stun mode against this suspect (see Table 3-5).

TABLE 3-5 Less Lethal force authorized for use in Scenario D

Less-lethal force	Less Lethal Force Authorized?	
	Yes	No
Soft empty-hand tactics/control	88.8%	11.2%
Hard empty-handed tactics/strikes/punches	91.3	8.7
OC spray, foam, or other chemical weapons	98.6	1.4
Baton (collapsible, straight, side handle, etc.)	85.6	14.4
CED in probe mode	94.8	5.2

CED in drive stun mode	89.8	10.2

Scenario E reads as follows: "When told by the officer that he is under arrest, the suspect swings at the officer's head with a closed fist. The officer dodges the blow and backs away, but the suspect continues to advance towards him with his fist raised." In response to this level of resistance, overwhelmingly the agencies allowed their officers to use any of the selected types of force. At least 93 percent of the agencies allowed their officers to use hard empty-handed tactics/strikes/punches (97.0%), chemical weapon (99.0%), a baton (98.2%), or the CED in probe mode (97.1%). That agencies were less inclined to allow their officers to use soft empty-hand tactics/control (88.2%) in this scenario is likely an acknowledgement that this would be an inadequate response to the threat posed (see Table 3-6).

TABLE 3-6 Less Lethal Force Authorized for Use in Scenario E

Less-lethal force	Less Lethal Force Authorized?	
	Yes	No
Soft empty-hand tactics/control	88.2%	11.8%
Hard empty-handed tactics/strikes/punches	97.0	3.0
OC spray, foam, or other chemical weapons	99.0	1.0
Baton (collapsible, straight, side handle, etc.)	98.2	1.8
CED in probe mode	97.1	2.9
CED in drive stun mode	93.8	6.2

Training

The survey solicited information from each responding agency regarding the total number of training hours received by the most recent class of recruits (both basic academy and

pre-service training. Respondents reported from 200 to 1800 hours, with an average of 620.2 hours.[11]

Respondents reported the number of training hours (including scenario-based training) spent on four force-related topics during their most recent academies. The mean number of hours spent on (1) firearms skills; (2) self-defense, arrest/control tactics; (3) use of less-lethal weapons; and (4) scenario-based use of force training not included in the hours provided above are 55.81, 47.88, 24.97 and 25.17, respectively. Again, the fewest number of training hours (e.g., for firearms skills and self-defense) were reported by small agencies (see Table 3-7).

TABLE 3-7 Hours Spent on Force Related Topics During the Most Recent Academy

Topic	Minimum # of hours (N)	Maximum # of hours (N)	Mean	Mode
Firearms skills	8	240	55.81	40
Self-defense, arrest/control tactics	4	245	47.88	40
Use of less-lethal weapons	0	106	24.97	40
Any scenario-based use of force training not included in the hours provided above	0	160	25.17	0

The survey solicited information on in-service training as well (that is, "training provided to active-duty, certified officers/deputies"). For nine use-of-force-related topics the survey asked first whether training on that subject matter had "been provided to some or all full-time sworn, line-level officers/deputies during the last two years" and then whether that topic was

[11] Nine agency responses with values under 200 hours were deleted as non-credible outliers (e.g., one agency reported only 64 academy training hours for recruits). To determine the cut-off point for defining outliers, we referred to results from the 2006 Census of Law Enforcement Training Academies conducted for the Bureau of Justice Statistics by the Police Executive Research Forum. The lowest value for the BJS item that corresponded to our own survey item was 200 and was not an outlier relative to other responses.

"mandatory for all full-time sworn, line-level officers/deputies." The responses to these questions are combined in Table 3-8. With the exception of training on the use of CEDs, at least 60 percent of the responding agencies had provided training on all listed topics to some or all full-time sworn, line-level personnel during the last two years. The low percentage for training on use of CEDs reflects the fact that many of the responding agencies do not deploy CEDs. (We return to the topic of CED training below.) The topic with the highest percentage of agencies reporting that it is mandatory for all of these line level personnel is "use of deadly force" (excluding qualification) at 71.3 percent. Following this topic, in descending order of the percentage of agencies for which training is mandatory, are "arrest and control tactics" (60.1%), "use of other less-lethal weapons" (57.9%), "physical combat skills" (54.6%), "dealing with citizens with mental illness" (44.1%), "officer survival" (41.6%), mediation skills/conflict management" (39.3%) and "de-escalation and defusing techniques (39.2%).

TABLE 3-8 In-Service Training for Full-Time Sworn, Line-Level Personnel

Topic	Provided During Last 2 Years	Mandatory for All
Physical combat skills (e.g., defensive tactics)	67.5%	54.6%
Arrest and control tactics	76.0	60.1
Mediation skills/conflict management	60.2	39.3
Use of CEDs	43.3	35.9
Use of other less-lethal weapons	74.5	57.9
De-escalation and defusing techniques	60.1	39.2
Use of deadly force (excluding qualification)	77.9	71.3
Officer survival	70.9	41.6
Dealing with citizens with mental illness	68.3	44.1

Some agencies require that personnel experience the effects of the less lethal weapon on which they are being trained. Concerning mandatory exposure to the effects of less-lethal weapons, three-fourths (77.4%) of respondents utilizing chemical sprays require officers to be exposed to their effects before being authorized to carry them. Slightly over 60 percent

(63.7%) of respondents that utilize CEDs require that their officers experience activation during training.

Force reporting/review

The survey solicited information regarding agency requirements pertaining to the reporting of force and the review of those reports. For 15 types of less lethal and lethal force, respondents indicated whether documentation of its use was "mandatory," "not mandatory," or not applicable because the "use of force option (was) not utilized by (the) department." As shown in Table3-9, for the following types of force, over 95 percent of agencies that use that force option mandate documentation: firearms discharges at vehicles that hit the vehicle (97.5%), firearms discharges at vehicles that miss (97.4%), CED in probe mode (97.3%), CED in drive stun mode (97.2%), baton strikes with injury (96.5%), and vehicle ramming (95.4%). Eighty-four percent (84.1%) of the agencies that use chemical agents mandate documentation of its use. Fifty-five percent (54.7%) of the agencies that deploy CEDs require that their personnel document when that weapon is "presented, arced or laser pointed" even in situations in which the weapon is not activated.

TABLE 3-9 Documentation of Force as Mandatory or Not Mandatory

Type of force	Force Utilized by Department		Use of force option not utilized by department
	Documentation mandatory	Not mandatory	
Chemical agents (e.g., OC, CS)	84.1%	15.9%	.6%
Baton strikes with injury	96.5	3.5	10.2
Baton strikes without injury	92.0	8.0	10.2
CED in probe mode	97.3	2.7	53.1
CED in drive stun mode	97.2	2.8	52.8
CED presented, arced or laser pointed (w/o activation)	54.7	45.3	53.0
Other impact devices (e.g., projectile or non-projectile)	93.8	6.1	67.6
Bodily force resulting in injury or claim of injury (e.g., hitting, striking, kicking or punching)	94.1	5.9	1.9
Bodily force not resulting in injury or claim of injury	85.6	14.4	1.8

Neck restraint/unconsciousness -rendering hold	83.1	16.9	51.8
Canine bites	93.6	6.4	47.9
Vehicle ramming	95.4	4.6	59.6
Firearms discharge at vehicles that hit	97.5	2.5	29.9
Firearms discharge at vehicles that miss	97.4	2.6	32.2
Pointing weapon at individual	70.9	29.1	.8

In 90.6 percent of the responding agencies, the mandated reports are completed by the officer/deputy; first-line supervisors complete these reports in 30.5 percent of the agencies. In 7.0 percent of the agencies, an individual in another rank (e.g., chiefs, sheriffs, lieutenants, captains) performs this task. Totals are above 100% as respondents could choose more than one option; in that regard, 22.4 percent of the agencies reported that both deputies/officers and first-line supervisors complete the mandated reports.

Respondents indicated the highest level at which incident reports "would normally be reviewed for justification if no injury to the subject occurs." Table 3-10 shows the highest level of review for each of four force categories: chemical spray, baton strikes, CEDs, and intentional firearms discharges at people that missed. Respondents who do not use the type of force are excluded. Twelve (12.0) percent of agencies report that chemical spray incidents are not reviewed up the chain of command if no injury occurs. With regard to chemical spray, baton strikes and CEDs producing no injury, in one-fifth to one-fourth of the agencies, first-line supervisors are the highest level of review. For these same types of force, 42 (42.7) to 56 (55.5) percent of the agencies involve the chief or sheriff in their review. Virtually all agencies (99.5%) review at the command level (13.6%) or above (85.9%) firearms discharges that miss their target.

TABLE 3-10 Highest Level of Force Incident Review If No Injuries Occur

Type of force	Not reviewed	First-line supervisor	Command level	Chief or sheriff
Chemical spray	12.0%	24.0%	16.4%	47.6%
Baton strikes	5.2	26.8	15.3	42.7
CEDs	0.3	20.5	23.7	55.5
Intentional firearms discharge at a person that did not hit	0	.5	13.6	85.9

Conducted energy devices (CEDs)

Because CEDs are currently the less lethal weapon receiving the most national attention, this weapon received more in-depth coverage in the survey. As reported above, just under half (47.1%) of the responding agencies deploy a CED, such as the Taser. Three-fourths of these agencies deploy these weapons to at least half of their uniformed patrol officers/deputies and supervisors assigned to respond to calls for service.

Regarding the year CEDs were first placed on the street, responses ranged from 1980 to 2006, with 73.3 percent of respondents reporting that their first CED was issued between 2004 and 2006. CEDs were first available to patrol supervisors as early as 1980 and to patrol officers/deputies and to special units as early as 1983, but for large proportions of responding agencies, CEDS were first given to patrol supervisors (72.3), patrol officers/deputies (75.7%), and special units (71.8%) during 2004 to 2006.

For six categories of personnel (e.g., patrol officers/deputies, investigators, school resource officer/deputies), responding agencies that deploy CEDs indicated whether or not CEDs are “routinely deployed” to the particular group and, if they are, the type of CEDs (e.g., Taser M26/X26, other, both) that are deployed to each. As indicated in Table 3-11, patrol officers/deputies (96.3%), patrol supervisors (92.3%), special operations units (75.7%) and other specialized units (70.9%) were most likely to be issued CEDs. Overwhelmingly, the personnel issued CEDs are issued weapons produced by Taser International (e.g., M26, X26).

Non-Taser CEDS that departments use include Nova Spirit, shock belts, stun guns, and Tasertrons.

TABLE 3-11 Whether and Type of CED Deployed to Employee Groups

Type of CED	Patrol officers/ deputies	Patrol Supervisors	Investigators	Special operations units (e.g., SWAT)	School resource officers/ deputies	Other specialized units (e.g., gang)
Taser (e.g., M26, X26)	96.3%	92.3%	40.4%	75.7%	48.1%	70.9%
Other	0.8	0.9	0	0	0	1.3
Both	0	0	0	.9	0	0
Not routinely deployed	2.9	6.8	59.6	22.4	51.9	27.8

Agencies that deploy CEDs report that officers/deputies receive between 0 and 40 hours of training before they are permitted to carry the weapon. Most agencies provide initial training of four hours (28.8%) or eight hours (46.6%); mean initial training length in hours is 8.15. The training provided by just under one-quarter of agencies (22.9%) exceeds that "required/recommended by the manufacturer." Those that exceed the manufacturer's requirement/recommendation most often exceed it by 2 (24.0%), 4 (32.6%) or 6 (28.4%) hours. Most agencies required officers/deputies to pass a written exam (96.5%) and/or practical exam (94.1%) "before they are permitted to carry a CED." Over half of the agencies (57.5%) train their officers/deputies on the topic of Excited Delirium.

One in five agencies (17.3%) does not require any re-training of deputies/officers who carry the CED. In contrast, two-thirds (64.0%) require retraining every year and 13.5 percent and 4.0 percent of agencies require training every two years or three years, respectively. Just over one percent (1.2%) has some other retraining requirement (such as four times a year, "as required," "on an as-needed basis"). The length of this retraining ranges from one to 16 hours. Most agencies provide 2 (23.5%), 4 (31.7%) or 8 (21.2%) hours of retraining; the mean is 4.33 hours.

The survey solicited information regarding CED policy to supplement the information produced by the scenario questions reported above. Just under 40 percent (38.4%) of the agencies have a stand-alone CED policy, and in another 52.2 percent, the department has "CED-specific language it its general use of force policy." In under six percent (5.7%) of the responding agencies, the department "does not mention CEDs in policy," and 3.3 percent have a stand-alone policy and also mention CEDs in the general use of force policy. Under one percent (.4%) reported some other policy situation.

As reported above, agencies conveyed through scenario-based items the circumstances in which CEDs can be used. The results as they pertain to CED use in probe mode and CED use in drive stun mode are re-presented in Table 3-12. One in five agencies (20.1%) authorize the use of the CED in probe mode when the subject in the scenario refuses, without physical force, to comply with the officer's commands (Scenario A). Thirty percent (29.6%) authorize drive stun mode in these circumstances. Just under 60 percent (58.7%) of agencies authorize probe mode activation against the subject who tenses and pulls against the officer as the officer tries to guide his hands behind his back (Scenario B). Almost two-thirds (65.2%) authorize a drive stun application for this situation. Three-fourths of the agencies (73.8%) authorize probe mode CED use against the subject who runs away (Scenario C); the corresponding percentage for drive stun mode is 68.8 percent. In the circumstance in which the subject "faces off against the officer with his hands raised in a 'boxer's stance'" (Scenario D), 94.8 percent of the agencies allow for CED use in probe mode and 89.8% allow it in drive stun mode. Finally, 97.1 percent and 93.8 percent of agencies allowed for CED use in probe and drive stun mode, respectively, when the subject takes a swing with his closed fist at the officer's head (Scenario E).

TABLE 3-12 Circumstances in which CEDs are Authorized in Probe or Drive Stun Modes

Scenario: Subject Actions (Scenario)	CED Authorized	
	In Probe Mode	In Drive Stun Mode
Refuses without physical force to comply (A)	20.1%	29.6%
Tense and pull (B)	58.7	65.2
Runs away (C)	73.8	68.8
Boxer's stance (D)	94.8	89.8
Takes closed fist swing at officer (E)	97.1	93.8

To determine how agencies place CEDs on the linear continuum relative to other types of force, respondents were provided with a list of 10 types of force and asked to indicate where each type "ranked" in their force continuum. Departments ranked these types of force from 1 to "highest" (the latter term acknowledging that there are varied numbers of levels in agencies' force hierarchies). Respondents could indicate the same number for several types of force if, in fact, those types of force are "ranked" at the same level in the force continuum. The ten types of force are:

- Verbal control commands
- Chemical incapacitants (e.g., OC, CS)
- CED (e.g., Taser)
- Control holds (e.g., escort, pain-compliance holds)
- Strikes/punches
- Baton/impact weapons
- Chemical/kinetic hybrids (e.g., pepper filled projectiles)
- Kinetic weapons or munitions (e.g., beanbag projectile)
- Incapacitation holds (e.g., neck restraints)
- Firearms

Table 3-13 provides the mean ranking for each type of force. The fact that agencies had different numbers of levels in their continuum should not reduce the ability of these means to show relative placement of types of force nationally. As expected, verbal control commands are at the low end of the continuum and firearms at the "top." CEDs are placed (1) above verbal control commands and control holds, (2) in relative close proximity to chemical incapacitants

and strikes/punches, and (3) below chemical/kinetic hybrids, baton/impact weapons, incapacitation holds, kinetic weapons/munitions and firearms.

TABLE 3-13 Relative "Rankings" of Types of Force in a Hierarchy

Type of force	Mean
Verbal control commands	1.00
Control holds (e.g., escort, pain-compliance holds)	2.11
Chemical incapacitants (e.g., OC, CS)	2.64
CED (e.g., Taser)	3.06
Strikes/punches	3.31
Chemical/kinetic hybrids (e.g., pepper filled projectiles)	4.03
Baton/impact weapons	4.05
Incapacitation holds (e.g., neck restraints)	4.36
Kinetic weapons or munitions (e.g., beanbag projectile)	4.40
Firearms	5.46

Another way to look at these data is to determine whether CEDS are placed above, below, or at the same level as other types of force. This perspective on the data is most relevant to the types of force immediately above and below CEDs in Table 3-13, such as chemical incapacitants and strikes/punches. Over half (57.0%) of the agencies place CEDs at the same level as chemical incapacitants. Over one-third (36.1%) place the CED higher on the linear continuum and 7.0 percent place CEDs lower than chemical incapacitants. A plurality of agencies (46.6%) place CEDs lower than strikes/punches on the continuum. One third of agencies (33.1%) place CEDs at the same level as strikes/punches; one in five (20.3%) place CEDS higher on the continuum than strikes/punches.

Because of nationwide controversy regarding the circumstances in which CEDs should be used, the respondents were asked to indicate whether their CED policy and/or placement of the CED on their use of force continuum/model had changed since January 2003. The question was not relevant to one-quarter of the agencies for various reasons (e.g., the CED deployment occurred since January 2003, the department does not reference CEDs in policy or on a

continuum). More than three-fourths (79.2%) of the remaining 178 agencies, had not changed their policies during the reference period. Of the remaining 37 agencies, 26 (70.3%) had expanded and 11 (29.7%) had reduced the circumstances in which officers/deputies could use the CED.

One aspect of the controversy surrounding CEDs is the use of this weapon against vulnerable populations or in certain circumstances that pose potentially heightened risk to the subject. To assess how agencies deal with these populations/circumstances, agency respondents indicated if their agency's policy, procedure and/or training on CED use in probe mode (1) prohibited CED use in all circumstances, (2) restricted use except when necessary and/or when special circumstances exist, or (3) placed no restriction. As set forth in Table 3-14, almost 70 percent (69.6%) of agencies prohibit the use of the CED against a person around flammable substances. No other circumstance is prohibited by a majority of agencies. Between 23 and 31 percent of agencies prohibit use of the CED against apparently pregnant women (31.0%), drivers of motor vehicles (25.9%), handcuffed suspects (23.3%), and people in elevated areas (23.2%). For these four special populations/circumstances, however, a plurality of agencies does not prohibit CED use but rather restricts it to "necessary" or "special circumstances." A majority of agencies has no restrictions on CED use on a subject threatening deadly force (82.4%), fleeing on foot (80.2%), who is emotionally disturbed (73.8%), and seems to be experiencing excited delirium (56.5%).

TABLE 3-14 Agency Policy, Procedure, Training Pertaining to Special Populations/Circumstances

Population/circumstance	Prohibits in all circumstances	Restricts use except in necessary, special circumstances	No restriction set forth
Driver of moving vehicle	25.9%	41.1%	32.9%
Person in elevated area (e.g., on bridge, in tree)	23.2	49.0	27.8
Youth/age	9.7	49.9	40.4
Youth/size	8.6	48.2	43.1
Elderly	10.0	53.2	36.8
Handcuffed suspect	23.3	51.8	24.9
Person around flammable substances	69.6	20.2	10.2
Person in/around water	17.0	49.5	33.5
Subject threatening deadly force	4.9	12.7	82.4
Person fleeing on foot	5.3	14.5	80.2
Known or apparent cardiac condition	20.7	32.4	46.9
Apparently pregnant woman	31.0	52.3	16.6
Apparently physically disabled person	10.6	46.9	42.5
Person who seems in Excited Delirium	8.3	35.1	56.5
Emotionally disturbed person	5.9	20.2	73.8

A strong majority (86.8%) of respondents has the same parameters (set forth in policies, procedures and/or training) for the use of CEDs in probe mode and drive stun mode. Less than five percent (4.3%) place more restrictions on drive stun than on probe mode, and 9.0% place more restrictions on probe mode than on drive stun mode.

A small minority of agencies (5.6%) restrict numerically the number of CED activations that can be administered. Almost all agencies (96.7%) that restrict the number of activations, set the maximum at three. Similarly, only one in five agencies (16.5%) restricts the activation length—mostly (99.6%) at five seconds. Just 5.4 percent restrict the total time a person can be

under CED activation. A total of 44 agencies out of 245 place one (n=30), two (n=4) or all three (n=10) of the above restrictions on CED use.

SUMMARY AND CONCLUSION

A national survey of a stratified random sample of U.S. law enforcement agencies produced information regarding the deployment of, policies for, and training with less lethal technologies. Over five hundred state and local agencies provided information on less lethal force generally and on their deployment and policies regarding CEDs in particular.

In most agencies, line-level personnel carry batons (straight and/or expandable) and handheld chemical agents. Just under half of the agencies deploy CEDs to at least some personnel. At least three-fourths of the agencies that deploy the expandable baton, the CED, or personal issue chemical agents, deploy these weapons to at least half of their uniformed line-level patrol officers/deputies and supervisors.

A large majority of agencies report the use of a continuum/model in policy and/or training to convey to their personnel the appropriate circumstances for using the various types of force authorized. Over half of those agencies, had a model they described as “linear.” A full one-third of responding agencies had recently changed or were in the process of changing their continuum/model.

Scenarios were used to assess agency policy regarding the circumstances in which various types of force could be used. Most agencies allowed only soft empty-hand tactics/control against a subject who refuses, without physical force, to comply with commands; just under half of the agencies would allow officers to use chemical weapons in this circumstance. If this subject, however, tenses and pulls when the officer tries to cuff him, a majority of agencies would allow chemical agents, hard-empty hand tactics/strikes/punches, and/or CED use. Forty percent of the agencies did *not allow* for the use of CED in probe mode in this tensing/pulling circumstance, but three-fourths did allow for CED use if the suspect fled and almost all allowed for CED use when the subject assumed a boxer’s stance. The baton

was reportedly not allowed by a majority of agencies in the scenarios until the subject threatened the officer by assuming a boxer's stance.

A majority of agencies mandate in-service training for all full-time sworn, line level employees on physical combat skills, arrest and control tactics, use of (other) less lethal weapons, and use of deadly force (beyond qualifying). Strong majorities of responding agencies require documentation of a broad array of force types; the agencies vary with regard to the highest levels at which various types of force are reviewed.

There were a number of questions on the survey pertaining to CEDs because of their recent re-emergence as a popular tool for law enforcement and the corresponding controversies regarding the weapon. Three-fourths of the agencies that deploy CEDs first issued them between 2004 and 2006. Most agencies are using devices produced by Taser International, Inc., and most are issuing these weapons to patrol officers/deputies, patrol supervisors, special operations units and/or other specialized units. Initial training is usually four or eight hours and six in ten CED-deploying agencies require that their officers experience activation during training.

As conveyed above, most agencies do not allow the CED to be used against a subject who refuses, without physical force, to comply with commands. Six in ten, however, allow for the use of a CED against a subject who tenses and pulls when the officer tries to cuff him. CED deploying agencies generally place the CED at the same level as chemical agents in their force continuum/model. Agencies vary as to the placement of CEDs relative to strikes/punches; CEDs are generally lower than impact weapons on a continuum/model.

For only one circumstance—subject near flammable substances—do a majority of agencies prohibit CED use. For most of the special circumstances or vulnerable populations listed in the survey, the agencies either made no particular mention of it in policy or restricted the CED use to special circumstances. A majority of agencies has no restrictions on CED use

on a subject threatening deadly force, fleeing on foot, who is emotionally disturbed, and/or seems to be experiencing excited delirium.

SECTION 4

AGENCY-LEVEL ANALYSIS

Another goal of the overall project was to obtain and analyze in-depth several use of force data sets from large departments representing different types of law enforcement agencies (municipal, county, sheriff's department) in different states. With that goal in mind, the University of South Carolina research team, utilizing its contacts with the Miami-Dade, FL Police Department, the Seattle, WA Police Department, and the Richland County, SC Sheriff's Department obtained use of force data from these agencies and subjected them to detailed analyses. The purpose for these agency-level analyses was to examine factors that predicted injuries to officers and citizens during use of force encounters. Each of the three data sets and the various techniques used to analyze them is discussed below.

Richland County Sheriff's Department (RCSD)

The RCSD is a full-service law enforcement agency of approximately 475 sworn officers that serves the unincorporated portions of Richland County, South Carolina.[12] RCSD deputies are equipped with Glock .40 pistols, collapsible metal batons, OC spray, and increasingly with the model X-26 Taser. The RCSD began phasing the Taser into use in late 2004. At the time of data collection, approximately 60 percent of patrol deputies were equipped with the Taser. During the period represented in this analysis, RCSD deputies adhered to the following linear use-of-force continuum, which was contained in a formal use of force policy and reinforced by training:

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[12] The population of unincorporated Richland County is about 200,000 people and is 50 percent White, 46 percent Black, and about 3 percent Hispanic. As a whole, the RCSD is a professional and well-trained agency that maintains excellent records on use of force. Each time that an RCSD deputy uses force beyond a firm grip, including the use or threatened use of a weapon, the deputy is required to complete a detailed use of force report. The reports capture basic demographic information on suspects and contain detailed data on the nature of the force that was used, drug or alcohol impairment of the suspect, the type of call, levels of suspect resistance, injuries sustained by officers or suspects, and the number of witnesses and officers present. Reports are reviewed by first-line supervisors, region commanders, the RCSD training unit, and internal affairs.

- Deadly Force
- Intermediate Weapons (Taser, baton, and OC spray)
- Hard Empty Hand Control (strikes and takedowns)
- Soft Empty Hand Control (joint locks and pressure points)
- Verbal Direction

RCSD variables

With the RCSD, use of force reports completed by officers are maintained in paper files but are not captured electronically. Data from these reports were coded and entered into a data file by trained graduate students for analysis. On average, the RCSD generates 30-40 use of force reports each month. For the purposes of this analysis, we coded 467 useable use-of-force reports[13] covering the year and a half period from January 2005 through July 2006. Summary statistics for the RCSD data appear in Table 4-1 below. The dependent variable in the RCSD models was no injury/injury and was binary coded as 0 or 1. Injuries also were coded in this fashion because of the relatively low number of total injuries in the data – 78 suspects and 46 officers – and because most injuries were minor (bruises, muscle strains, cuts, or abrasions). Of the 49 separate injuries recorded for officers (three officers had more than one injury), 46 involved bruises, abrasions, or lacerations. For suspects, 92 separate injuries were recorded, and 69 of those were bruises, abrasions, or lacerations.

[13] A handful of reports were excluded because they were incomplete or reflected force used only on animals.

TABLE 4-1 Summary Statistics for RCSD Data

Variable	*Range*	*Mean*	*SD*
Dependent Vars.			
Officer Injury	0-1	0.10	0.30
Suspect Injury	0-1	0.17	0.37
Indp. Vars.			
Soft Empty Hand Control	0-1	0.59	0.49
Hard Empty Hand Control	0-1	0.10	0.30
OC Spray	0-1	0.10	0.30
Taser	0-1	0.18	0.38
Collapsible Baton	0-1	.03	.182
Canine	0-1	0.04	0.19
Threatened Handgun	0-1	0.30	0.46
Passive Resistance	0-1	0.34	0.48
Defensive Resistance	0-1	0.51	0.50
Active Aggression	0-1	0.37	0.49
Deadly Force	0-1	0.08	0.27
Num. Witnesses	0-5	1.54	1.18
Suspect Resisted Arrest / Assaulted Officer	0-3	0.72	0.62
Num. Officers	1-18	2.50	1.72

Most of the remaining suspect injuries were dog bites, although three involved broken bones or internal injuries. Given the number and distribution of injuries, we could not create an injury severity index that might have served as the basis for a different type of analysis (see discussion of Miami-Dade models below), such as an ordered logistic regression approach. This is a limitation to our analysis and one that is common to injury research in the police setting. With the exception of canine bites, moderate and severe injuries to officers and suspects are rare events (at least in our data) and therefore large amounts of data would be needed to model these unusual outcomes.

The independent variables in the RCSD models included measures of officer force, suspect resistance, and the numbers of officers, witnesses, and resistant suspects on the scene at the time of an incident. The officer force variables all were binary coded as either 0 (type of force not used) or 1 (type of force was used). Likewise, suspect resistance levels also were binary coded as 0 (type of resistance not offered) or 1 (type of resistance offered). Although

conceptualized as force and resistance in many use of force continua, verbal commands by officers and verbal resistance by suspects were not included in the models reported because of their low probability for producing injury.[14] The independent variables for the numbers of officers, suspects, and witnesses present were recorded as simple counts of persons in each category present at the scene. These situational variables were available in the data and were included in the models because of their significance as predictors of force in previous research (Garner, Maxwell, & Heraux, 2002).

RCSD models

For the RCSD analysis, two sets of two logistic regression models were estimated, for a total of four separate models. One set of models pertained to officers and the other pertained to suspects. In Model 1 reported for officers and suspects, only the variables discussed above were included. In the second model (Model 2), two interaction terms were computed and included for the purpose of determining whether the inclusion of these variables would moderate the relationship between the original terms and the probability of injury. In particular, a multiplicative interaction term for soft empty hand control (by officers) and active aggression (by suspects) was included in the second officer model, and an interaction term for hard empty hand control (by officers) and active aggression (by suspects) was included in the second suspect model.

These interaction terms were included for two reasons. First, active aggression was a significant predictor of injuries in the initial models for both officers and suspects, while soft empty hand and hard empty hand control were significant in the officer and suspect injury models respectively. More importantly, the use of low level control (soft empty hand) by officers against actively aggressive suspects contravenes RCSD use-of-force policy and training (which suggest higher levels of control) and may have contributed to the officer injuries associated with

[14] In fact, we ran the models with verbal "force" and resistance included but found no substantive differences in the outcomes reported.

soft empty hand control in the first officer model. Although the use of hard empty hand control against actively aggressive suspects is within the range of alternatives available to officers under policy, we were interested in evaluating whether the combination of hard empty hand control and active aggression contributed to injuries to suspects. Thus, an interaction term for this effect was included in the second suspect injury model.

As the dependent variable was dichotomous (injury/no injury), binary logistic regression was used to calculate the odds of injury. Furthermore, unlike many use of force reports, the RCSD report requires officers to indicate *all* types of force that were used rather than just the highest level of force. Thus, if an officer attempted to use soft empty hand control (e.g. a pressure point) but then transitioned to an intermediate weapon (e.g. CED), then both levels of force would have been captured on the report. Likewise, all levels of suspect resistance were captured in the data as well. This detailed reporting allowed us to consider all relevant types of force and resistance *together* in the models and permitted us to estimate injury probabilities for each. This provides a distinct advantage over the analyses reported in the existing police use of force/injury literature, which typically cannot disentangle which type of force or resistance produced an injury because the full range of force and resistance is not represented in the models.

Finally, we note a limitation to our analysis of the RCSD data. Although we were able to clearly identify each suspect and the injuries that he or she sustained, we were unable to identify how many times a particular officer appeared in the data set. Because one might expect to see correlated injury outcomes (for either officers or suspects) associated with the same officer appearing multiple times in the data, there is potentially some level of non-independence among the cases represented in our analysis that could impact standard errors and tests of statistical significance (see, e.g., Bliese & Hanges, 2004; Moerbeek, 2004).

RCSD findings

Table 4-2 shows the results from the logistic regression analysis that examined predictors of injuries to deputies in the RCSD. In the first model, which does not include the interaction terms, the following variables either reached statistical significance at the .05 level or came close: Soft Empty Hand Control (p = .053), Active Aggression (p = .014), and Deadly Force (p = .055). For the purposes of this discussion, all three are treated as being statistically significant.

TABLE 4-2 Logistic Regression Models of Deputy Injury, RCSD

	Model 1			Model 2		
Variable	*B*	*p*	e^B	*B*	*p*	e^B
Soft Hands	.959	.053	2.608	.269	.672	1.308
Hard Hands	.509	.252	1.664	.432	.336	1.541
OC	.227	.669	1.255	.228	.665	1.256
Collapsible Baton	-.139	.870	.870	-.100	.908	.905
CED	.383	.367	1.467	.392	.360	1.480
Canine	.017	.988	1.017	-.086	.940	.918
Firearm	-.535	.368	.586	-.580	.328	.560
Passive Resistance	-.415	.267	.660	-.441	.243	.643
Defensive Resistance	.389	.317	1.475	.452	.252	1.572
Active Aggression	.890	.014	2.436	-.336	.710	.715
Deadly Force	1.108	.055	3.028	1.143	.048	3.137
# of Resistant Suspects	.327	.316	1.387	.411	.222	1.508
# of Deputies	.017	.889	1.018	.021	.859	1.022
# of Witnesses	-.103	.527	.902	-.112	.502	.894
Soft Hands * Active Aggression	----	----	----	1.503	.128	4.497
Constant	-3.825	.000	----	-.3.426	.000	----
Model χ^2	37.97; p = .001			40.51; p = .000		
Pseudo R^2	.079 / .168			.084 / .178		
N	459			459		

Notes: B = log odds, e^B = odds ratios; R^2 = Cox & Snell's and Nagelkerke's, respectively; N = number of observations after listwise deletion.

Recall from Table 4-1 (summary statistics) that soft empty hand control was the most frequent level of force used by deputies. Fifty-nine percent of all use of force encounters in Richland County resulted in an officer using soft empty hand control techniques on a suspect. After holding all other force and resistance levels constant, Model 1 from Table 4-2 indicates that the use of soft empty hand control techniques increased the odds of officer injury by about 160 percent. Thus, deputies were at greatest risk for injury when using the lowest level of physical force on the existing RCSD use of force continuum, a finding consistent with previous

research on suspect and officer injuries (Smith & Alpert, 2000; Smith & Petrocelli, 2002). Not surprisingly, deputies also were at increased risk for injury when confronted with a suspect who was actively aggressive or who posed a threat of deadly force. In fact, of the three statistically significant variables in the model, the deadly force variable showed the highest odds ratio (3.028), indicating that the odds of injury to deputies increased by a factor of two when faced with a suspect exhibiting a threat of deadly force.

Model 2 in Table 4-2 includes an interaction term between Soft Empty Hand Control and Active Aggression. Although the interaction term itself was not statistically significant, it was fairly close at the .10 level (p = .128), suggesting that the increased probability for officer injury associated with soft empty hand control tactics may have been partially a function of the use of these techniques against actively aggressive suspects. Seemingly then, officers were at greater risk for injury when using low-level control techniques against suspects who exhibited a higher relative level of resistance.

Table 4-3 (below) is the counterpart to Table 4-2 and shows predictors for suspect injuries. In the first model, the variables Hard Empty Hand Control, OC (pepper spray), Canine, Deputy Aimed Gun at Suspect, and Active Aggression were statistically significant. Among these, two variables – OC and Deputy Aimed Gun at Suspect – showed a reduction in the odds of injury. In fact, after controlling for all other levels of force and resistance, the use of OC reduced the odds of an injury occurring to a suspect by almost 70 percent (odds ratio = .306, p = .046). This finding is consistent with the existing research on OC, almost all of which has found low injury rates associated with this less lethal force alternative (Edwards, Granfield, & Onnen, 1997; Gauvin, 1995; Morabito & Doerner, 1997). Similarly, pointing a weapon at a suspect reduced the odds of injury by more than 80 percent (odds ratio =.181, p = .001). Since there were only three firearms discharges recorded in the RCSD dataset (all misses), it appears that pointing a firearm at a suspect effectively ended the suspect's resistance in the vast majority of potential deadly force encounters. In contrast, the use of an RCSD canine posed, by

far, the greatest risk for injury to suspects. The use of a canine increased the odds for injury by almost 40 fold (odds ratio = 41.37, p = .000). Suspects who exhibited active aggression towards deputies also were more likely to suffer injury (odds ratio = 2.05, p = .020). Interestingly, CED use was statistically insignificant and neither increased nor decreased the odds of injury to suspects (odds ratio = .950, p = .892). This finding is inconsistent both with the Seattle and Miami-Dade results reported below and with most of the emerging literature on the relationship between Taser usage and injury (Bozeman, 2008; Charlotte-Mecklenburg Police Department, 2006; Hougland, Mesloh, & Henych, 2005; Seattle Police Department, 2002), suggesting that not every agency's experience with the Taser will be the same.

TABLE 4-3 Logistic Regression Models of Suspect Injury, RCSD

	Model 1			Model 2		
Variable	*B*	*p*	e^B	*B*	*p*	e^B
Soft Hands	.250	.514	1.284	.273	.477	1.314
Hard Hands	.906	.021	2.473	1.222	.60	3.393
OC	-1.185	.046	.306	-1.189	.045	.305
Collapsible Baton	.299	.680	1.349	.314	.666	1.369
CED	-.051	.892	.950	-.059	.875	.942
Canine	3.723	.000	41.374	3.759	.000	42.893
Firearm	-1.709	.001	.181	-1.713	.001	.180
Passive Resistance	.005	.988	1.005	.017	.956	1.017
Defensive Resistance	-.182	.568	.833	-.212	.512	.809
Active Aggression	.718	.020	2.051	.793	.018	2.210
Deadly Force	.774	.175	2.167	.775	.174	2.171
# of Resistant Suspects	.185	.494	1.203	.178	.509	1.195
# of Deputies	.102	.329	1.107	.104	.323	1.109
# of Witnesses	-.180	.220	.835	-.193	.195	.824
Hard Hands * Active Aggression	----	----	----	-.479	.554	.619
Constant	-2.105	.000	----	-2.124	.000	----
Model χ^2	83.01; p = .000			83.36; p = .000		
Pseudo R^2	.165 / .278			.166 / .279		
N	459			459		

Notes: B = log odds, e^B = odds ratios; R^2 = Cox & Snell's and Nagelkerke's, respectively; N = number of observations after listwise deletion.

Model 2 in Table 4-3 included an interaction term to account for the possible interaction between Hard Empty Hand Control and Active Aggression. However, the interaction term was not nearly statistically significant (odds ratio = .619, p = .554). Thus, the increased probability for injury associated with the use of hard empty hand control tactics and an actively aggressive

suspect is apparently not the result of the interface between those two variables. Both increased the likelihood of suspect injury independent of each other.

Miami-Dade Police Department (MDPD)

With approximately 3,000 sworn personnel, the MDPD is the largest law enforcement agency in the Southeast and one of the largest departments that has never issued OC spray to its patrol officers.[15] Miami-Dade police officers have been armed with semi-automatic weapons and intermediate weapons, including batons and the PR-24. In 2003, the Department purchased M-26 Tasers and has since made the transition to the X-26 model. Although at the time of data collection the MDPD had not reached full deployment, approximately 70% of officers carried the Taser. The Department's use of force policy follows the traditional linear model that includes verbal direction, minimal control tactics, physical control, intermediate weapons and deadly weapons.

MDPD variables

Data from the MDPD consist of 1,178 use-of-force incidents that occurred between January 2002 and May 2006. Given the structure of the data and the complexity of analyzing incidents involving multiple officers using multiple types of force and multiple suspects using multiple types of force, we simplified the MDPD analysis by extracting incidents that involved a lone officer and a lone suspect for this analysis (N = 762).[16] Summary statistics for the MDPD data appear in Table 4-4 below.

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[15] The MDPD provides police services to the unincorporated areas of Miami-Dade County, Florida, which together contain more than 1 million people in a 1,840 square mile area. The population is about 20 percent black, 80 percent white, and 55 percent Hispanic. The overall racial composition of the department is comparable to that of the county (about 23% black, 56% Hispanic, and 21% non-Hispanic white). The MDPD is a highly professional department that has earned international and state accreditation. Its Training and Professional Compliance bureaus are widely recognized as exemplary. The department is a leader in collecting and maintaining comprehensive reports and general statistics on the use of force. The Supervisor's Report of Response to Resistance detail the actions of the officer(s) and suspect(s). In addition, there is a separate form that must be completed when an officer discharges a CED. These reports are reviewed at several levels, including supervisors, training and Professional Compliance.

[16] We caution readers that the dynamics of use-of-force encounters involving multiple suspects and/or multiple officers in the MDPD may be different than those involving single officers and single suspects. Consequently, inferences regarding injuries in the present study are necessarily limited to the latter context.

TABLE 4-4 Summary Statistics for MDPD Data

Variable	*Range*	*Mean*	*SD*
Dependent Vars.			
Officer Injury	0-1	0.17	0.37
Suspect Injury	0-1	0.56	0.50
Indp. Vars.			
Soft Empty Hand Control	0-1	0.37	0.48
Hard Empty Hand Control	0-1	0.08	0.27
Taser	0-1	0.43	0.50
Canine	0-1	0.06	0.24
Suspect Resistance	1-5	3.80	1.18
Suspect Age	7-73	30.84	11.83
Suspect Race	0-1	0.52	0.50
Suspect Sex	0-1	0.90	0.31
Suspect Impaired	0-1	0.34	0.47
Officer Race	0-1	0.71	0.45
Years of Service	0-34	10.01	6.67

Officers were substantially less likely to be injured than suspects, with 16.6 percent (124) of officers injured and 56.3 percent (414) of the suspects injured. As with the RCSD, most officer and suspect injuries were minor, but 73 suspects (17%) suffered more serious injuries.[17] As with the RCSD injury data, we coded injuries among MDPD officers and suspects as a dichotomous dependent variable – no injury/injury (0,1) – and modeled this outcome using binary logistic regression.

The MDPD does not issue pepper spray to its line officers, and there were too few gun and baton uses to include them as separate regressors. Suspect resistance is included in the MDPD model, but it is treated as an ordinal regressor with five categories ranging from no resistance to assaults on officers. However, for comparative purposes we also test a dichotomous version of the variable, coded 1 if the suspect actively resisted and zero otherwise.[18] Control variables include suspect age, officer length of service, and dummy indicators of suspect sex (coded 1 if male), suspect impairment (coded 1 if impaired by drugs or

[17] Major injuries (N = 73 or 17%) include bites, punctures, broken bones/fractures; internal injuries, gunshot wounds; minor injuries (N = 341 or 46%) include bruises/abrasions, sprains/strains, lacerations, and other.
[18] The ordered suspect resistance variable is coded as 1 = no resistance, 2 = passive resistance, 3 = flight, 4 = actively resisted arrest, and 5 = assaulted officers. The dichotomous version is coded 1 if suspects actively resisted arrest or assaulted officers and zero otherwise.

alcohol), and officer and suspect race (coded 1 if nonwhite and zero if Caucasian). Note that information on officer age was not available, and there were not enough female officers in the dataset to include officer sex as a variable.

MDPD models

As in the RCSD and SPD analyses, we estimate separate binary logistic regression models for officer and suspect injuries. We also include an interaction term for *officer soft empty hand control* by *suspect resistance* in the second officer injury model, and an *officer hard empty hand control* by *suspect resistance* interaction term in the second suspect injury model. Because of the larger sample size, the standard errors in all models are adjusted to account for the clustered nature of the data (i.e., use-of-force incidents nested within officers) (Long and Freese, 2001:74).

MDPD findings

Tables 4-5 and 4-6 present the MDPD logistic regression results for officer and suspect injury, respectively. As shown in Model 1 in Table 4-5, the use of both soft hand tactics (odds ratio = 2.33, p = .02) and hard hand tactics (odds ratio = 2.62, p = .012) by officers more than doubled the odds of officer injury. Conversely, the use of CEDs was associated with a 68 percent reduction in the odds of officer injury (odds ratio = 0.32, p = .040). Among the remaining regressors, only the level of suspect resistance was statistically significant, with each increase in the level of suspect resistance associated with a 160 percent increase in the odds of officer injury (p = .000).

TABLE 4-5 Logistic Regression Models of Officer Injury, MDPD

	Model 1			Model 2		
Variable	*B*	*p*	e^B	*B*	*p*	e^B
Soft Hands	.847	.020	2.334	1.444	.420	4.239
Hard Hands	.964	.012	2.621	.989	.008	2.687
CED	-1.135	.040	.321	-1.088	.019	.337
Canine	-.370	.495	.691	-.294	.624	.745
Suspect Resistance	.954	.000	2.597	1.042	.005	2.837
Suspect Age	-.001	.930	.999	-.001	.922	.999
Suspect Race	.095	.798	1.100	.101	.791	1.106
Suspect Sex	.223	.685	1.25	.222	.683	.999
Suspect Impaired	-.167	.474	.847	-.158	.524	.853
Officer Race	.136	.694	1.145	.129	.704	1.138
Soft Hands * Suspect Resistance	----	----	----	-.124	.760	.883
Constant	-5.841	.000	----	-6.276	.002	----
Pseudo R^2	.229 / .315			.229 / .316		
N = 621	621			621		

Notes: *B* = log odds, e^B = odds ratios; R^2 = McFadden's and Nagelkerke's; N = number of observations after listwise deletion; constants are not exponentiated; model χ^2 values not reported with adjustments for clustering.

These results are somewhat congruent with the RCSD and the Seattle Police Department (SPD) results (see below) in that the direction of the estimates for soft-hand and hard-hand control tactics are the same in the case of the RCSD and comparable to the estimates for physical force in the SPD model. In other words, in all three departments, the use of physical control techniques by officers increased the likelihood of officer injury. A major difference, however, concerns the effect of CEDs, which was statistically insignificant and in the opposite direction in the RCSD and insignificant in the SPD. Further, although the interaction term between officers' use of soft hand tactics and active resistance by suspects was nearly significant at the .10 level in the RCSD model, as shown in Model 2 in Table 4-5, it is not nearly significant at the .10 level in the MDPD model (odds ratio = .883, *p* = .760). The dichotomized version of the suspect resistance variable also was not nearly significant (odds ratio = 2.11; *p* = .503).

Regarding the model for suspect injury, Model 1 in Table 4-6 (below) indicates that officer use of any hands-on tactics (soft hands or hard hands) significantly increased the odds of

suspect injury (only hard-hands tactics were significantly associated with suspect injury in the RCSD model), a finding that contrasted with the non-significant relationship between similar variables in the SPD. The use of canines increased greatly the odds of suspect injury (odds ratio = 20.54, p = .000), a finding congruent with the RCSD results. However, while CED use was unrelated to suspect injury in the RCSD, the use of CEDs by officers in the MDPD decreased substantially the odds of suspect injury (odds ratio = .129, p = .000), as it did in the SPD. If we reverse the sign of the coefficient for CED prior to exponentiation, we find that CED use was associated with a 677 percent increase in the odds of suspects *not* being injured during use-of-force encounters. Thus, whereas hands-on tactics significantly increased the risk of injury among both officers and suspects, CEDs significantly decreased the risk of injury to both groups.

TABLE 4-6 Logistic Regression Models of Suspect Injury, MDPD

	Model 1			Model 2		
Variable	*B*	*p*	e^B	*B*	*p*	e^B
Soft Hands	1.542	.000	4.676	1.522	.000	4.581
Hard Hands	.932	.009	2.539	-2.694	.080	.068
CED	-2.050	.000	.129	-2.065	.000	.127
Canine	3.022	.000	20.535	2.984	.000	19.760
Suspect Resistance	.223	.015	1.250	.196	.030	1.217
Suspect Age	.008	.523	1.008	.007	.570	1.007
Suspect Race	-.801	.003	.449	-.808	.003	.446
Suspect Sex	.737	.038	2.090	.747	.031	2.110
Suspect Impaired	-.098	.673	.906	-.093	.697	.911
Officer Race	-.010	.981	.990	-.006	.988	.994
Hard Hands * Suspect Resistance	----	----	----	.814	.013	2.257
Constant	-.525	.599	----	-.394	.687	----
Pseudo R^2	.449 / .616			.451 / .618		
N = 621	621			621		

Notes: *B* = log odds, e^B = odds ratios; R^2 = McFadden's and Nagelkerke's; N = number of observations after listwise deletion; constants are not exponentiated; model χ^2 values not reported with adjustments for clustering.

Among the other significant findings in Model 1, we see that each increase in the level of suspect resistance was associated with a 25 percent increase in suspect odds of injury (odds ratio = 1.25, p = .015), a finding consistent with the RCSD results but inconsistent with the SPD

results. We also observe that the odds of injury were approximately double for male suspects compared to female suspects, and that the odds of injury were significantly *lower* for nonwhite suspects than for white suspects. Finally, unlike in the RCSD model, the interaction term between level of suspect resistance and officer use of hard hands was statistically significant and positive, indicating an increase in the odds of suspect injury when officers resorted to the use hard hand tactics at higher levels of suspect resistance (odds ratio = 2.26, p = .013).[19]

Seattle Police Department (SPD)

The Seattle Police Department, established in 1886, is a nationally accredited agency employing approximately 1,200 sworn law enforcement officers. In 2006, it served an estimated population of 582,174. The agency began deploying M26 Tasers in December 2000. In 2005, it transitioned to the X26, and by the end of 2006, over half of all patrol officers had been trained and authorized to carry the Taser X26. The department also deploys other less-lethal weapons, including pepper spray, batons, and shotgun bean-bag rounds.

SPD variables

The SPD data consist of 676 use-of-force incidents that occurred between December 1, 2005 and October 7, 2006. Table 4-7 presents the descriptive statistics for the variables used in the analysis. Suspects were injured in 64 percent of the incidents, while one or more officers were injured in 20 percent of the incidents. Physical force (any hands-on tactic without the use of weapons) was used by one or more officers in 76 percent of the incidents. The next most frequent type of force employed by officers was the Taser (36%), followed by OC spray (8%). The data included other types of force usage, such as batons and canines, but there were too few reported to be included in the analysis (18 baton uses and 23 canine deployments). The number of officers involved in use-of-force incidents ranged from 1 to 11, with an average of 1.72 officers per incident. One-fifth of the incidents involved one or more nonwhite officers, 17

[19] Note, however, the interaction term using dichotomous version of the suspect resistance variable was not nearly statistically significant, though the direction of the effect is consistent (odds ratio = 1.51, p = .805).

percent involved one or more female officers, and the average age of officers was 36. Suspects resisted officers using physical force or the use or the threat of the use of a weapon in 71 percent of the incidents. Suspects were impaired by alcohol, drugs, or mental illness in over three-fourths of the incidents (76%). Over half (52%) the suspects were nonwhite, their average age was 33, and 95 percent were male.

TABLE 4-7 Summary Statistics for SPD Data

Variable	*Range*	*Mean*	*SD*
Dependent Vars.			
Suspect Injury	0-1	0.64	0.48
Officer Injury	0-1	0.20	0.40
Indp. Vars.			
Physical Force	0-1	.76	.43
OC Spray	0-1	.08	.28
Taser	0-1	.36	.48
Number of Officers	1-11	1.72	.99
Officer(s) Age	22.4 – 58.8	36.476	5.93
Officer(s) Sex	0-1	.17	.37
Proportion Nonwhite Officers	0-1	.20	.34
Suspect Resistance	0-1	.71	.45
Suspect Impaired	0-1	.76	.43
Suspect Nonwhite	0-1	.52	.50
Suspect Male	0-1	.95	.33
Suspect Age	11-76	32.867	10.99

SPD models

Like with the analyses for the other jurisdictions, we estimate separate binary logistic regression models for officer and suspect injuries. Because so few encounters reportedly involved more than one suspect (N = 30), we restrict the analysis to single-suspect incidents. However, the structure of the SPD data does allow for an analysis of multiple-officer incidents. This may be important because incidents involving multiple officers may be qualitatively different than incidents involving lone officers, and the relationships of the independent variables and injury outcomes may vary accordingly. One consequence of including multiple-officer incidents, however, is that the outcome variable for officer injury means that one or more officers may have been injured in any incident involving more than one officer.

SPD findings

Models 1 and 2 in Table 4-8 present the findings from the regression analysis of suspect and officer injuries. As Model 1 shows, physical force is associated with an increase in the odds of suspect injury, but the effect is not statistically significant at even the .10 level (p = .122). Again, and in contrast, the use of physical control tactics (hard hands) increased the likelihood of suspect injury in both the RCSD and the MDPD. The effect of OC spray is in the expected direction, but it also is not statistically significant (p = .213), a finding that contrasts with the effect of OC spray in the RCSD (reduction in suspect injury). Note, however, the lack of significance may be because there were few reported uses of OC spray in the data (N = 57). Taser use, however, was associated with a statistically significant reduction in the odds of suspect injury, as it was in the MDPD. Specifically, Taser use was associated with a 48 percent decrease in the odds of injury. Conversely, reversing the sign of the coefficient and then exponentiating indicates a 192 percent increase in the odds of injury when Tasers were *not* used.

Multiple-officer incidents also were more likely to involve injuries to suspects (p = .043), with each additional officer being associated with a 28 percent increase in the odds of injury. Because of the truncated distribution of the number of officers, we also entered this variable as a dummy indicator, coded 0 if one officer was involved and 1 if more than one officer was involved. The variable continued to be statistically significant (p = .040) and suggests that the odds of injury increased by 60 percent when more than one officer was involved. Whether or not one or more nonwhite officers were involved in a use-of-force incident clearly had no effect on the odds of injury (p = .815). This variable continued to be insignificant when entered as the proportion of nonwhite officers involved (β = .025; p = .926). Increases in the average age of officers involved in force encounters was associated with a decrease in the odds of suspect

injury, as was the presence of one or more female officers[20], though both effects are significant only at the .10 level (p = .070 and p = .085, respectively). Impairment by drugs, alcohol or mental illness was associated with a 50 percent increase in the odds of suspect injury (p = .052), while males suspects were associated with a 140 percent increase in the odds of injury (p = .001). Nonwhite suspects were less likely to have been injured, but the effect is statistically significant only at the .10 level (p = .099). Both suspect age (p = .345) and suspect resistance (p = .864) were unrelated to injury.

Model 2 presents the results for officer injuries. Although the effect was in the expected direction, the use of OC spray (p = .259) and Tasers (p = .137) was unrelated to officer injury, as it was in the RCSD. Only in the MDPD did Taser use decrease the chances of injury to officers. The use of unarmed tactics by officers, however, is statistically significant (p = .005), suggesting a 258 percent increase in the odds of officer injury when they used physical force. Recall that the findings on these variables were inconsistent in the RCSD and the MDPD; neither soft nor hard hand control was related to deputy injuries in the RCSD, while both were related to officer injury in the MDPD. The average age of officers involved in force incidents was unrelated to officer injury (p = .543), but officer odds of injury increased significantly with increases in the number of officers involved (p = .002). The model suggests that each additional officer was associated with a 46 percent increase in the odds of officer injury, while entering the variable as a dichotomy indicates use-of-force encounters involving more than one officer were associated with a 165 percent increase in the odds of injury (β = .973; $p \leq .000$). The model also indicates that the involvement of one or more female officers was associated with a 121 percent increase in the odds that an officer would be injured (p = .004). Not unexpectedly, the odds of officer injury increased significantly when suspects resisted using physical force or the use or

[20] We enter officer sex as a dichotomy (zero vs. one or more female officers) rather than as the proportion or number of female officers involved in use-of-force incidents as there were few female officers in the dataset (N = 112).

the threat of the use of a weapon, (β = .607; *p* = .036). The remaining variables in the model were statistically unrelated to officer injury (all *p* ≥ .158).

TABLE 4-8 Logistic Regression Models of Suspect and Officer Injury, SPD

	Model 1 (Suspect Injury)			Model 2 (Officer Injury)		
Variable	*B*	*p*	e^B	*B*	*p*	e^B
Physical Force	.413	.122	1.512	1.275	.005	3.579
OC Spray	-.407	.213	.666	.442	.259	1.556
Taser	-.654	.004	.520	-.408	.137	.665
Number of Officers	.246	.043	1.279	.375	.002	1.455
Officer(s) Age	-.026	.090	.974	.012	.543	1.012
Officer(s) Sex	-.414	.093	.661	.794	.004	2.212
Nonwhite Officers	.047	.815	1.048	.130	.585	1.138
Suspect Resistance	-.036	.864	.965	.607	.036	1.836
Suspect Impaired	.403	.052	1.496	-.125	.622	.882
Suspect Nonwhite	-.307	.099	.735	.114	.613	1.120
Suspect Male	.866	.001	2.378	.049	.882	1.050
Suspect Age	-.008	.345	.992	-.014	.159	.986
Constant	.560	.468	1.750	-3.723	.000	.024
Model χ^2	57.07; *p* = .000			71.68; *p* = .000		
Pseudo R^2	.087 / .120			.108 / .171		
N	625			625		

Notes: *B* = log odds, e^B = odds ratios; R^2 = McFadden's and Nagelkerke's, respectively; N = number of observations after listwise deletion; model χ^2 values not reported with adjustments for clustering.

SUMMARY AND CONCLUSION

These analyses utilized multiple regression to predict injuries associated with the use of force in general and intermediate weapons specifically. Importantly, the three sites differed in that Richland County deputies and Seattle Police officers had the ability to use OC spray while the Miami-Dade officers did not have that option, though all three agencies had CEDs. The findings from Richland County indicated that the use of OC on suspects was one of the most important variables linked to a reduction in suspect injury, while CED use was unrelated to suspect injury. The data from the Miami-Dade Police Department, whose officers did not have access to OC as an intermediate weapon, showed that the use of CEDs was associated with reductions in injury to both officers and suspects. The results from the Seattle Police Department fell somewhere in between and showed CED-related injury reductions to suspects

but not to officers. Moreover, unlike in Richland County, the use of OC spray in Seattle neither increased nor decreased the odds of injury to officers or suspects.

Why CED use was not associated with a significant reduction in injuries in the RCSD is unclear. However, since the majority of the RCSD deputies had a long history of using OC spray and the introduction of CEDs was relatively recent, the reliance on OC may have mitigated its injury reduction effects. Perhaps if both sites had a similar history with the same less-lethal weapon options, the findings would have been more comparable. Additional research in other settings may shed further light on this, but the results of this study suggest that not every agency's experience will be the same regarding CED use and injuries. The results from Seattle bear this out, as CED use reduced injuries to suspects but not to officers. Nonetheless, it is clear that the use of CEDs and OC *can* have a significant and positive effect on injury reduction.

Whereas CEDs and OC spray, which typically are deployed some distance from resistive or combative suspects, were associated with injury reduction, the use of hands-on tactics that require officers to be in close physical proximity to suspects to effect arrests was associated with an increased risk of injury to both officers and suspects, although some variations on this finding existed among the three agencies. Although we do not advocate the blind or wholesale substitution of intermediate weapons for hands-on tactics, the RCSD analysis suggests that some deputies were more likely to be injured when using soft-hand controls to subdue actively aggressive suspects. To the degree that OC and/or CEDs would be authorized and appropriate for use in such encounters, their deployment in place of soft empty-hand controls may help prevent some injuries, albeit mostly minor ones.

Interestingly, non-white suspects were less likely to be injured than white suspects in both agencies (MDPD and SPD) where suspect race was available as a variable for analysis. Although we cannot speculate as to the cause of this finding, or whether it is merely spurious, it is encouraging that minority suspects were not *more likely* to be injured than whites. To the

extent that injuries may be a proxy for the intensity or severity of force used, it does not appear that minority suspects were the targets of disproportionately severe force compared to whites.

An additional important finding in this study concerns the use of canines and suspect injury. Few researchers have examined police use of canines in broader use-of-force studies (see, e.g., Garner et al., 2003; Kaminski et al., 2004) and fewer still have examined the association between the use of police dogs and suspect injury (Hickey and Hoffman, 2003; Mesloh, 2006). However, police dog bites can produce serious injuries (Dill, 1992), and an analysis by Cambell et al. (1998) found that although minorities were no more likely to be bitten than whites, canines were disproportionately deployed in areas with greater concentrations of minority residents, even after controlling for levels of crime and other factors. Our analysis shows that while canines were used infrequently, their deployment increased substantially the risk of injury to suspects in both the RCSD and the MDPD.

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SECTION 5

MULTIAGENCY ANALYSIS

In addition to analyzing data from selected agencies individually, we also sought to combine use of force data sets from multiple agencies and examine injury outcomes across as many agencies as possible. To begin this process, we used the data generated from the PERF National Use of Force Survey to identify responding agencies that indicated that they captured injury information on officers and citizens (Q. 19) and that they maintained use of force data in an electronic format (Q. 13). We further selected on agencies that had at least 100 sworn officers in order to seek data sets that contained sufficient numbers of use of force incidents to provide for a robust analysis. Finally, because CED use was an important variable to consider in this analysis, we selected on agencies that reported issuing CEDs to their officers. One of the primary questions that we hoped to address with the multiagency analysis was how the use of CEDs impacted injuries to officers and citizens. After applying the selection criteria, 26 agencies were identified as possibly having data that met the requirements for this analysis.

With the list of 26 agencies in hand, we began contacting the agencies by telephone to further assess the compatibility of their data and to request their participation in the study. We soon found that many of the 26 agencies did not actually have use of force and injury data available in an electronic format that could be accessed and converted into a data file for analysis. In other cases, the agencies' records management systems were not set up to easily retrieve the data. For these agencies, participation in the study would have required the devotion of substantial resources and specialized programming (often from a third party vendor) to retrieve the data for analysis. In addition, some agencies did not maintain the data that we needed in a database; rather, they captured and stored images of paper-based use of force forms (as PDFs or similar) that had to be downloaded and coded by hand. Still other agencies

had major flaws in the way that they captured and stored information, which rendered their data unusable.

As the original list of 26 eligible agencies dwindled, the USC research team sought participation from other agencies with which it had contacts (and which were not survey respondents) and sought the assistance of PERF in identifying additional agencies whose data may have been suitable for analysis. This process resulted in the identification and participation of two additional agencies, but it also resulted in ruling out another handful of agencies which, again, did not have suitable data. Finally, as the USC research team began constructing the master data set for the multiagency analysis, the team decided to include the data that it already had from the Miami-Dade Police Department, the Richland County Sheriff's Department, and the Seattle Police Department. Table 5-1 below shows the final list of agencies (N = 12) whose data were combined for the multiagency analysis. The table lists the participating agencies, dates represented in their data, and notable data limitations. The data limitations are further elaborated upon and discussed below.

TABLE 5-1 Agency Data Used in Multiagency Analysis

Jurisdiction	Time Frame	# Observations	Comments and Major Limitations
Austin, TX Police	2002 – 2006	6,596 'rows'	Unable to identify number of suspects or officers per force incident.
Cincinnati, OH Police	2003 – 2007	4,313 incidents	Limited information on types of force used by officers (thus type of force variables = CED, OC & physical); suspect age unavailable.
Harris County, TX Sheriff	2005	468 'rows'	No information on multiple suspects or multiple officers involved in force incidents. Limited information on types of suspect resistance (thus type of resistance variables = physical & with weapon); no detailed information on nature of injuries; many CED-related injuries may be due to probe punctures only.
Hillsborough County, FL Sheriff	2005	150 'rows'	Detailed suspect injury descriptions frequently unavailable; many CED-related injuries may be due to probe punctures only.
Los Angeles Police	2005	1,785 incidents	Single officer – single suspect incidents only; substantial missing data.
Los Angeles County Sheriff	2005	2,161 incidents	Single officer – single suspect incidents
Miami-Dade Police	2002 – 5/05	762 incidents	No precise date of incident variable; some missing data on officer use of force; too few reports of use of impact weapons for inclusion; OC spray not authorized.
Nashville, TN Police	6/30/04 – 6/30/07	1,965 incidents	No data on officer injury in 2004
Orlando, FL Police	1998 – 2006	4,577 'rows'	No measure of suspect resistance available.
Richland County, SC Sheriff	1/1/05-6/30/06	441 'rows'	No information on multiple suspects or multiple officers involved in force incidents; no precise date of incident information.
San Antonio Police	3/1/04-3/31/07	1,237 incidents	No information on multiple suspects or multiple officers involved in force incidents; officer injury information unavailable.
Seattle, WA Police	12/1/05-10/7/06	676 incidents	Single suspect incidents. Data include officer demographics.

Note: 'rows' indicates that the dataset did not contain a unique use-of-force incident number or other information that enabled us to determine whether multiple rows of data were related to the same incident or different incidents; 'incident' indicates that the dataset contained information that enabled us to make this determination.

Data and Limitations

As we began working with the data obtained from the various agencies, it quickly became evident that the datasets varied widely both in terms of their quality and the number of variables available for analysis. This was not a major issue for the agency-level analyses earlier, but it was much more problematic for the proposed multiagency analysis. This is because the multiagency analysis requires the inclusion of as many important variables as possible for explaining injury patterns while simultaneously retaining all or most agencies for that analysis. For example, while it is desirable to measure suspect resistance with the most precision possible (e.g., passive resistance, active resistance, aggressive resistance, aggravated resistance), some agencies only provided dichotomous indicators of whether or not suspects resisted. To retain the agencies that provided only dichotomous indicators, the more precise measures of suspect resistance from other agencies had to be collapsed into dichotomous indicators. In terms of variable availability, some agencies provided many more variables for analysis than did other agencies. For example, some departments provided measures of suspect impairment, but many did not. Consequently, this variable must be excluded from consideration in the multiagency analysis. Thus, there is a tradeoff between retaining the maximum number of agencies for analysis and the precision of the measures and/or the number of measures used in the analysis.

The data issues for the most part be can classified into three categories: 1) variation across agencies in the types of variables available, 2) variation across agencies in the measurement of variables; and 3) variation across agencies regarding the availability of unique officer and suspect identifiers (which, when present, allowed us to determine the number of officers or suspects involved in any given use-of-force incident). Each issue is discussed in turn.

Types of variables available

Regarding the dependent variables, all 12 agencies provided data on suspect injury, and all but one provided data on officer injury. Most agencies provided information about suspect demographic characteristics; eight provided data on suspect age, race and sex, three on race and sex, and two did not provide any data on suspect demographic characteristics. Only four agencies provided data on officer demographic characteristics, with two providing information on officer age, race and sex and two on officer sex and race. Some agencies provided comprehensive data on many different types of force used by their officers. Regarding physical force, for instance, some departments reported in detail the type of force that was used (e.g. firm grips, wrist locks, arm bars, takedowns, punches, elbow strikes, and kicks), whereas other departments only indicated if officers used physical force rather than the exact type of force used. This limited the kinds of force we could include in the multiagency analysis. Classifying force into just three types allowed for the retention of the greatest number of agencies. Specifically, we include indicators of physical force (any use of hands, fists, feet), chemical agents (pepper spray), and CEDs. Including all three measures of force allows all agencies to be included in the analysis, although not all agencies contributed information on all levels of force. The Miami-Dade Police Department, for example, does not authorize the use of pepper spray for its officers and San Antonio did not authorize CEDs. All agencies but one provided measures of suspect resistance.

In addition to the various individual and situational-level variables available, we also sought to include a policy measure for how the 12 agencies regulated the use of CEDs and OC spray among officers in the field. The PERF survey contained five hypothetical use of force scenarios (see Q.5 in Appendix A) that asked the responding agencies to indicate whether a CED or OC spray was authorized to be used in the

scenario under the agency's existing use of force policy. The scenarios ranged from passively resistant suspects (goes limp, sits down) to assaultive suspects (swings at officer's head with a closed fist). An examination of these data generally revealed four types of policies: (1) those that authorized CED or OC spray use against even passively resistant suspects, (2) those that authorized CEDs or OC spray against defensively resistant (muscle tensing, struggling) suspects, (4) those that authorized CED and OC spray against fleeing suspects, and (4) those that authorized CED or OC spray use only for actively aggressive suspects. For analytic purposes, we collapsed these categories of responses into a dichotomous variable that represented (1) a more restrictive OC spray or CED policy (suspect exhibited defensive resistance or higher) or (2) a less restrictive OC spray or CED policy (weapons could be used against passively resistant suspects).

Finally, it is important to note that the data represent only records routinely captured by police departments and are missing many qualitative features of these events, such as the nature of the incident that spurred the initial contact between the police and the citizen (e.g., domestic disturbance, robbery, routine traffic stop, etc.), whether the suspect was under the influence of alcohol or a controlled substance, or the duration of the incident. These factors have been shown in prior research to be correlated with differences in the seriousness and consequences of force incidents (Adams, 1999; Alpert & Dunham, 2004; Kaminski & Sorensen, 1995). Thus, like all analyses outside of an experimental setting, our models are to some degree misspecified.

Measurement of variables

Although some variables (e.g., demographic) were measured and reported in the same way by most agencies, there were stark differences in how some other variables were measured and/or reported. A case in point is the injury variable. Some agencies included not only an indicator of whether or not there was an injury, but a measure of the severity of the injury as well (e.g., none, minor, major). Some, additionally, included a brief narrative describing the nature of the injury. A couple of agencies, however, provided only a dichotomous indicator of whether or not there was an injury. Having greater detail regarding injuries imparts a number of important analytical benefits, such as the ability to model predictors of injury severity as opposed to a more limited analysis of whether or not an injury occurred. Examination of injury narratives can be used as a validity check on the other injury indicators in the same dataset. For instance, some agencies counted skin irritation from pepper spray and CED dart punctures as injuries. However, this is inconsistent with how we operationalized injuries from these devices in this study, and the additional details allowed us to recode these cases (note that CED dart punctures to unapproved targets, such as the groin or face, were counted as injuries). Unfortunately, this could not be done in all datasets

Suspect level of resistance may be conceptualized as running along a continuum from no resistance (or verbal resistance) to maximum resistance (e.g., trying to seriously injure or kill an officer). Some agencies reported suspect actions that more accurately reflected a continuum of resistance, whereas others reported only simple dichotomies indicating whether or not suspects assaulted officers . For instance, one agency used seven categories in its classification of suspect resistance (verbal resistance, passive resistance, defensive resistance, active resistance, active aggression, aggravated active aggression, deadly force assaults, and deadly force), whereas another agency classified

resistance as verbal resistance, passive resistance, and physical resistance. In fact, no two classification schemes were precisely alike, and one agency did not provide data on suspect resistance.

Although the broader measures more fully reflect the concept of resistance, it was necessary to collapse all resistance measures into a dichotomous measure in order to retain as many agencies as possible in the multiagency analysis. However, even collapsing the measures into a simple dichotomy presented challenges. Some departments, for example, indicated whether or not suspects resisted defensively or actively, but others only indicated that suspects resisted at a level below "combative" but above verbal or passive. In the end, we decided to code the variable to indicate that suspects resisted to some degree above passive resistance, realizing that some conceptual ambiguity remains regarding the measure. Under this scheme, resistance was operationalized as anything equal to or greater than "defensive" resistance (muscle tensing, fleeing on foot, grasping onto a fixed object).

Conducted energy devices may be used in two different modes; touch-stun mode involves pressing the prongs of the device against a subject and therefore requires close contact between an officer and subject, while dart-mode involves shooting the darts at the subject, typically from a longer distance. Touch-stun activations are used primarily as a pain compliance technique, while dart mode is typically used to incapacitate subjects. Because each mode has a different effect and is activated from different distances from subjects, injury patterns could vary by the mode employed. Consequently, it is desirable to be able to measure which mode or modes were used during force encounters. Very few agencies, however, provided this level of detail, thus necessitating the use of a simple dichotomous indicator of CED use.

Measures of race/ethnicity also varied across datasets. While most measures included the typical white, black, Hispanic and "other" categorizations, two agencies did not indicate ethnicity (Hispanic), and two did not include an "other" category.

Unique officer and suspect identifiers

Some datasets contained unique incident identification numbers for each use-of-force encounter as well as unique officer and/or subject identification numbers (IDs). Thus, for example, a file may contain 10 rows of data with each row having the same incident ID number. If the officer ID field also contains a value that repeats over the same 10 rows, we then know the incident involved a single officer. If an officer ID repeats for five of rows of the data and a different officer ID repeats for the next 5 rows for the same incident ID, then we know two officers were involved, and so forth. Some datasets, however, did not contain unique officer or subject IDs, and therefore, we were unable to determine the number of officers or subjects involved per incident, which precludes the use of officer and/or subject count variables for the multiagency analysis.[21] In other cases, although we were able to identify the number of subjects per use-of-force incident, we elected to remove multiple-subject incidents from the data because they represented so few cases. For example, in Seattle and Nashville, the number of incidents that involved more than one suspect was 30 (4.0% of the total) and 77 (3.8% of the total), respectively.

In short, the multiagency analysis includes some datasets that treat some rows of data containing information about multiple officer and/or multiple suspects involved in a single use-of-force incident as though they were separate incidents. One consequence

[21] In addition to being able to calculate the number of officers and suspects involved in use-of-force incidents, the presence of unique incident numbers and officer and subject IDs in conjunction with demographic data also allows for the calculation of, e.g., the proportion of female officers involved in use-of-force incidents, the average length of service for officers involved, and whether the officers were all white, all black, or some combination thereof (see, e.g., the Seattle analysis).

of this is that some observations are not independent of one another, i.e., they are "nested" within force incidents, which without statistical adjustments may affect the calculation of standard errors in the regression analysis.[22] Although we are unable to determine the number of single-officer versus multiple-officer incidents for these datasets, an examination of agency data for which we can make this determination suggests that between about 50 percent and 75 percent of use-of-force incidents involved lone officers. For the multiagency data overall, this means that the number of non-independent observations probably ranges between approximately 12 and 25 percent of the total.

Nature of the Analysis

In order to investigate the relationship between situational and policy-related factors and the likelihood of injuries in police use of force incidents, the multiagency analysis focused on the administrative data from the twelve police agencies shown in Table 5-1 above, all of which provided information on suspect race and gender. Additionally, we include a subset analysis for the ten agencies that also included information on suspect age. With the data limitations previously discussed in mind, our multiagency analysis focuses on data that were extracted for a comparable set of measures from each agency and that enable us to adjust for the demographic and situational differences between police use of force incidents. The outcome measure for this multiagency analysis focuses on whether the use of force event resulted in a recorded injury to the suspect or officer.

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[22] A second source of non-independence of observations is the nesting of force incidents within officers, i.e., some officers are involved in multiple use-of-force incidents during the period of study and thus appear multiple times in the dataset.

Because the outcomes from police use of force events do not occur at random, it is likely that there are features of individual situations that will be confounded with the likelihood that a police use of force incident will result in an injury to either suspects or officers. In particular, it is important to control for differences in the features that are associated with injuries that may result from the basic population characteristics of citizens involved in force events (including race, gender, and age), the level of physical force applied by the police officer(s) during the encounter, and whether any type of non-lethal weapon was utilized (CED or OC spray). Departmental differences in policies authorizing the conditions under which non-lethal technologies may be used also may confound the relationship between case characteristics and the likelihood that a force event will result in an injury to suspects or officers. In the subsequent analysis we control for these factors in the multiagency examination of the correlates of use of force injuries.

Summary of measures

The basis descriptive statistics for the measures of situational and demographic attributes for the ten agencies included are displayed in Table 5-2. Out of the total of 24,530 force events with information on suspect injuries, approximately 39% (n=9,595) resulted in a reported injury to a suspect. Out of a total of 23,438 force incidents with information on injuries to officers, approximately 14 percent (n=3,240) involved an officer injury. Approximately 31 percent (n=7,555) of all suspects were white and averaged 30 years of age. In close to 56 percent of encounters, officers used physical force on a suspect. And, in close to 77 percent of encounters suspects physically resisted. Officers used chemical spray (OC) in approximately 23 percent of these cases and a CED in close to 22 percent of all force encounters.

Table 5-2 also includes a comparison of the average characteristics between injury and non-injury cases. A comparison of these descriptive data indicates a number of differences in the average suspect and situational characteristics between force events that resulted in an injury to suspects and officers compared to those that did not.[23] A significantly higher proportion of suspects injured were white compared to situations where suspects were not injured. Suspects who were injured were also slightly older on average. The distribution of suspect age by group (injury vs. non-injury) is displayed in Figure 5-1and indicates a clear curvilinear pattern for both groups – consistent with the well established age crime curve (Blumstein et al., 1986). Suspects were on average less likely to be injured if a chemical spray (OC) or a CED device was used against them than if it was not. In contrast, suspects were on average more likely to be injured if they showed any physical resistance to the police. In addition, suspects were less likely to be injured if the department had a policy that restricted OC or CED usage to defensive resistance or greater rather than against passively resistant suspects.

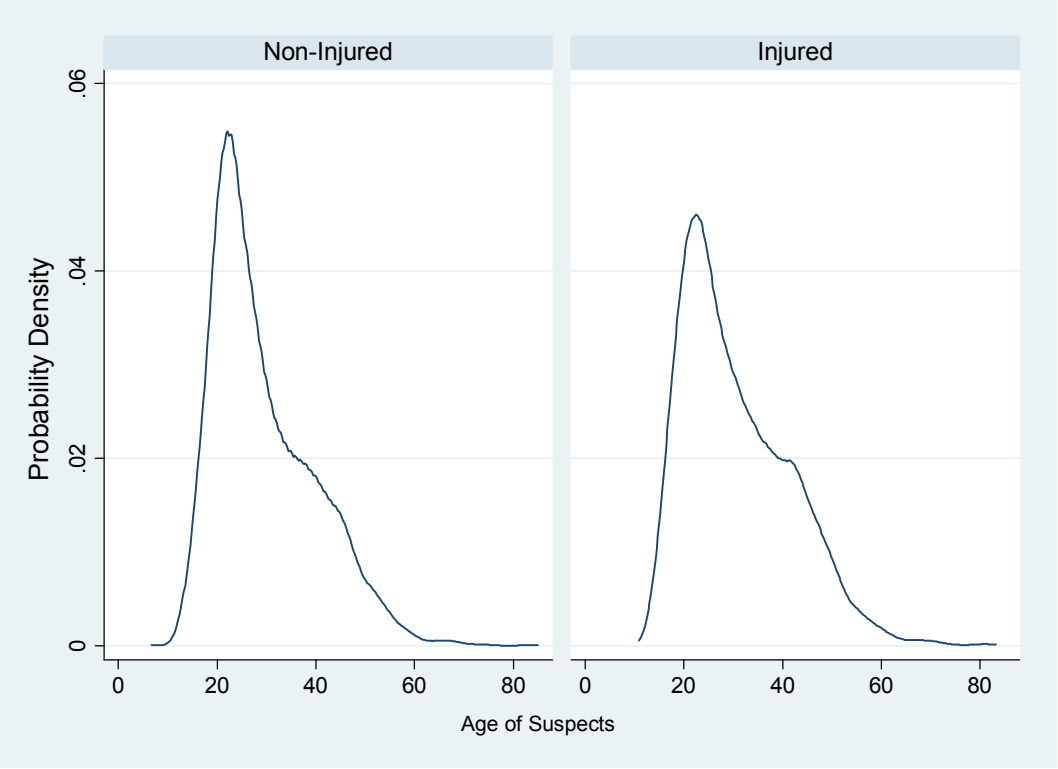
[23] We applied the Kolmogorov-Smirnov test for equality of distribution functions between the two groups, rather than the conventional t-test for mean differences, because this test is less sensitive to extremes at the tails of each group's distribution.

TABLE 5-2 Descriptive Statistics of Key Measures for Suspects and Officers

Suspects *Variable*	*Overall n= 25,358 (%)*	*(%) Injury*	*(%) Non-injury*	*KS (D=)*	*P-value*	*Score Range*
Demographics						
Suspect White, %	24,104 (31)	34	29	0.047	<0.00	0-1
Suspect Male, %	24,264 (88)	92	85	0.067	<0.00	0-1
Suspect Age, mean	13,987 (30)	31	29	0.057	<0.00	7-85
Situational Attributes						
Physical Force, %	24,295(56)	71	47	0.237	<0.00	0-1
OC, %	24,378 (23)	13	30	0.167	<0.00	0-1
CED, %	24,296 (22)	14	27	0.130	<0.00	0-1
Resistance, %	18,469 (77)	79	75	0.042	<0.00	0-1
Departmental Policy						
Defensive CED, %	24,380 (65)	59	70	0.107	<0.00	0-1
Defensive OC, %	24,380 (89)	87	90	0.034	<0.00	0-1
Officers *Variable*	*Overall n= 25,358 (%)*	*(%) Injury*	*(%) Non-injury*	*KS (D=)*	*P-value*	*Score Range*
Demographics						
Suspect White, %	22,888 (32)	32	32	0.000	1.00	0-1
Suspect Male, %	22,961 (87)	88	87	0.011	0.92	0-1
Suspect Age, mean	12,601 (30)	29	30	0.025	0.18	7-85
Situational Attributes						
Physical Force, %	22,943(55)	84	50	0.339	<0.00	0-1
OC, %	23,029 (23)	23	23	0.001	1.00	0-1
CED, %	22,944 (24)	13	25	0.124	<0.00	0-1
Resistance, %	17,423 (76)	85	74	0.111	<0.000	0-1
Departmental Policy						
Defensive CED, %	23,288 (68)	62	69	0.071	<0.00	0-1
Defensive OC, %	23,288 (94)	93	94	0.008	1.00	0-1

KS= Kolmogorov-Smirnov test for equality of distribution functions between the two groups
Notes: Defensive CED and OC = authorized for defensive resistance (mid-range of the linear resistance continuum)

FIGURE 5-1 Age Distribution of Suspects by Injury Status



Suspect demographic characteristics had little relationship with the differences in the distributions of cases in which officers were injured. Situational exigencies were more clearly associated with differences between officers who were injured in a force event and those who were not. Eighty-four percent of officers injured applied physical force compared to only 50 percent of cases where officers were not injured. There was no difference in officer injury by the use of chemical sprays (OC), but 13 percent of officers injured in events used a CED compared to 25 percent of cases where officers were not injured. Eight-five percent of officers injured had suspects physically resist compared to only 74 percent of cases where officers were not injured. Officers were also less likely to be injured in events if the department had a defensive resistance (or greater) policy for CED devices.

The observed differences in the case features of the samples for suspect and officer injury outcomes suggests the need to adjust for these factors in our subsequent analysis of situational and policy-related factors related to the likelihood of injuries.

Analytic strategy

We estimated the relationship between individual, situational, and agency-level features of use of force cases and the likelihood of suspect or officer injuries using multilevel and fixed-effects regression models.[24] First, we specify a multilevel logistic regression model of injury to suspects and officers (separately) according to the following form:

$$\eta_{ij} = \beta_o + \beta x_i + \gamma_j \quad i = 1...N; j = 1...N \quad (1)$$

Here η_{ij} represents the odds ratio of experiencing an injury during a use of force event or the log [P(*Yij* = 1)/ P(*Yij* = 0)] for individual force incident *i* in agency *j.* In equation (1), βx_i represents the vector of individual attributes (race, age, gender, physical force, OC…), with a random effect parameter (γ_j) that represents an intercept term, allowing the effects of individual attributes in the model to shift up or down according to each police agency location (*j*). Thus, β_0 represents the intercept term or the average likelihood of injury, adjusting for individual case features and group (random) differences across police agencies.

To examine whether the department policies operating at the group-level are associated with the probability of injury separately from individual case features, we extend the specification of the equation and substitute coefficients measuring

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[24] These models are also referred to as hierarchical linear models in the field of education statistics (Raudenbush & Bryk, 2002) or variance components models in biostatistics and economics (McCulloch et al., 2001). See either of the noted citations for a full description of the statistical properties of these models, their limitations, and applications.

departmental policies – restricting the use of OC or CED to defensive resistance or higher – in place of the random effect intercept term ($\gamma\omega_j = \gamma CED_j + \gamma OC_j$).[25] One benefit of the multilevel specification is that it allows us to include agency-level variation in the estimation, which may (or may not) be an important source of variability between force incidents. The age distribution of suspects displayed in Figure 5-1 indicates a clear curvilinear pattern. Therefore, we also specify separate models for agencies with suspect age data as a polynomial function ($\sum$ age, age^2). The error structure (e_{ij}) of the multilevel models is composed of both individual (fixed) and agency-level (random) variance that is normally distributed with mean 0 and variance σ^2.[26]

Second, we estimated a fixed-effects regression model that takes into account individual characteristics of events and removes the average between-agency differences in the probability of suspect or officer injuries. We specify a fixed-effects logistic regression according to the following form:

$$\eta_{ij} = \beta_o + \beta x_i + \nu_j \quad i = 1...N; j = 1...N \qquad (2)$$

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[25] The multilevel models with coefficients for departmental policies were specified with an error structure that allows for an exchangeable covariance matrix, thus allowing a shared variance among departmental policies but a common pair-wise covariance with individual case features. We believed this error structure at the departmental-level was more realistic than one that specified the structure of departmental policies as independent of each other. It is also worth noting that the group level intercept term was substituted to improve the numerical stability in our optimization. With only 12 agencies and over 20,000 cases it was numerically unstable to partial out these policies as separate group-level parameters that operate independently of the overall average across all departments.

[26] These models were estimated using Stata Version 10.0, where the distribution of the random effects is assumed to be Gaussian and the conditional distribution of the response function (injuries) is assumed to be Bernoulli, with the probability of experiencing an injury determined by the logistic cumulative distribution function (CDF). The log likelihood for this model has no closed form, so it is approximated in Stata by an adaptive Gaussian quadrature (see Stata Corporation, 2005).

Here η_{ij} represents the odds ratio of experiencing an injury during a use of force event, or the log [P(*Yij* = 1)/ P(*Yij* = 0)], for individual force incident *i* in agency *j.* In equation (2), βx_i represents the vector of individual case attributes (race, age, gender, physical force, OC…), with parameters (dummy variables) controlling for average differences between police agencies (ν_j). Thus, β_0 represents the intercept term, or the average likelihood of an injury adjusting for individual case features and average differences between police agencies. Thus, this model allows one to examine the relationship between characteristics of force events and the likelihood of an injury (suspect or officer) after removing average (fixed) between-agency differences. The fixed-effect model assumes that slopes for the covariates in the model are the same across the units, although the intercepts vary by police agency (ν_i). The benefit of using a fixed-effects model is that it controls for the average difference between agencies – rather than assuming they are randomly distributed - and can provide unbiased estimates of the slope parameters, assuming that there is no important omitted variable bias.

Results

The results from the multilevel and fixed effect logistic regression models are reported in odds ratios (OR) and 95% confidence intervals (CIs). Because of the large sample sizes estimated, we focus our primary interpretation on odds ratios with values close to 0.5 or above 2.0. Odds ratios in this range imply the same relative expected value of half the reduction or two times the increase. Panel A in Table 5-3 (below) presents the multilevel models for suspect injury outcomes. Model 1 shows the results for the baseline association of suspect injuries that includes only dummy variables for race (White=1), sex (Male=1), physical force, conducted energy device (CED=1), and chemical spray (OC=1), allowing the average differences between agencies to vary

freely (random effect intercept). The results indicate that the application of physical force by the police and the use of OC or CED devices are significantly associated with suspect injuries. The application of OC or CEDs reduces the odds of suspect injury by

TABLE 5-3 Suspect, Situational, and Department-level Covariates of Suspect and Officer Injury

Panel A. Suspects	**Model 1**			**Model 2**			**Model 3**		
Variable	*OR*	*95% CI*	*p-value*	*OR*	*95% CI*	*p-value*	*OR*	*95% CI*	*p-value*
Physical force	1.54	1.43-1.66	<.001	1.95	1.76-2.15	<.001	1.38	1.26-1.50	<.001
OC	0.30	0.28-0.33	<.001	0.39	0.34-0.43	<.001	0.34	0.31-0.38	<.001
CED	0.34	0.31-0.37	<.001	0.49	0.43-0.55	<.001	0.41	0.37-0.46	<.001
Sex (1=male)	2.12	1.94-2.34	<.001	2.10	1.86-2.38	<.001	2.30	2.07-2.56	<.001
White (v. others)	1.19	1.13-1.27	<.001	1.17	1.07-1.27	<.001	1.19	1.11-1.29	<.001
Resistance				1.27	1.16-1.40	<.001	1.26	1.16-1.36	<.001
Age	--	---		1.01	0.99-1.03	0.07	---	---	---
Age^2	--	---		0.99	0.99-1.00	0.27	---	---	---
Defensive CED	---	---	---	---	---	---	0.57	0.30-1.09	0.08
Defensive OC	---	---	---	---	---	---	1.32	0.70-2.52	0.38
Likelihood Ratio (X^2)	2,137		<.001	440.98		<.001	1,343		<.001
Level 1 (n=events)	24,004			12,508			18,168		
Level 2 (n=agencies)	12			9			11		

Panel B. Officers	**Model 1**			**Model 2**			**Model 3**		
Variable	*OR*	*95% CI*	*p-value*	*OR*	*95% CI*	*p-value*	*OR*	*95% CI*	*p-value*
Physical force	4.07	3.64-4.57	<.001	3.63	3.13-4.22	<.001	3.60	3.14-4.12	<.001
OC	1.39	1.26-1.54	<.001	1.22	1.07-1.40	<.001	1.21	1.07-1.36	<.001
CED	0.97	0.85-1.09	0.585	0.95	0.82-1.12	0.57	1.02	0.89-1.18	0.743
Sex (1=male)	1.12	0.99-1.27	0.055	1.17	1.02-1.36	0.027	1.17	1.02-1.34	0.022
White (v. others)	0.87	0.80-0.95	0.002	0.83	0.75-0.91	<.001	0.83	0.75-0.91	<.001
Resistance				1.73	1.53-1.97	<.001	1.76	1.57-1.99	<.001
Age	--	---	---	1.02	0.99-1.04	0.07	---	---	---
Age^2	--	---	---	0.99	0.99-0.99	0.03	---	---	---
Defensive CED	---	---	---	---	---	---	1.19	0.59-2.35	0.635
Defensive OC	---	---	---	---	---	---	1,18	0.78-1.79	0.424
Likelihood Ratio (X^2)	675.84		<.001	458.85		<.001	527.56		<.000
Level 1 (n=incidents)	22,649			11,321			17,003		
Level 2 (n=agencies)	11			8			10		

Note: OR=odds ratios. X^2= Likelihood ratio test comparing multilevel variance component to single variance logistic regression.

70 percent (OR=0.30; 95% CI=0.28-0.33) and 66 percent (OR=0.34; 95% CI=0.32-0.38) respectively. The average expected odds of suspect injury for males is close to twice that of females (OR=2.12; 95% CI=1.94-2.34). The use of physical force by the police increases the odds of a suspect injury by 1.54 (54%) compared to those events where physical force was not applied (95% CI=1.43-1.66). Race was only marginally associated with an increased odds of suspect injury, with white suspects having a slightly higher odds of injury (OR=1.19; 95% CI=1.13-1.27) compared to other groups.

Model 2 includes the same set of covariates and includes suspect resistance and age covariates for the nine agencies that had complete data on these factors. The results from this model are substantively the same to those presented in model 1 for the suspect and situational case characteristics. The results are substantively similar to those presented in models 1 and 2 and indicate that the use of physical force is associated with an increased likelihood of suspect injury (OR=1.95; 95% CI=1.76-2.15). Suspects who resist have a 27% greater likelihood of being injured than those who do not resist (OR=1.27; 9%% CI=1.16-1.40). The odds of suspect injury is substantially lower for the average case where OC (OR=0.39; 95% CI=0.34-0.43) or CED (OR=0.49; 95% CI=0.43-0.55) technologies were used. Age has a nonlinear relationship but is not significantly associated with the risk of suspect injury.

Model 3 displays the results for the same set of situational case characteristics (excluding age), but adds the two covariates representing departmental restrictions on OC spray or CED use to defensive resistance or higher (specified at the department level), thus allowing us to ascertain whether the covariates of suspect injury are conditional on departmental difference in these policies. Importantly, departmental level differences in policies restricting the use of OC or CEDs to defensive resistance or greater are not significantly associated with differences in suspect injury outcomes, nor do they have a material effect on the associations between individual force case features and injury outcomes for suspects. These findings, however, are not surprising, given that once use of force events unfold, it is more likely that the

individual exigencies of a situation will play a primary role in determining the severity of the outcome rather than policy restrictions.

Panel B in Table 5-3 presents the multilevel models for officer injury outcomes. Model 1 shows the results from the baseline model that includes only the suspect and situational characteristics for the 11 agencies with data on basic case characteristics. The average adjusted odds of an officer injury was four times greater if an officer applied physical force in a given situation compared to if he or she had not (OR=4.07; 95% CI= 3.64-4.57). The odds of officer injury was marginally higher if an officer used OC spray (OR=1.39; 95% CI=1.26-1.54) and if the suspect was a male (OR=1.12; 95% CI=0.99-1.27). The results from model 1 also indicate that the odds of officer injury are slightly lower if the suspect was white compared to another racial group (OR=0.87; 95% CI= 0.80-0.95). Model 2 presents the results from the eight agencies that included information on suspect ages and resistance. The results are substantively the same as previous baseline specification but indicate that age (in individual year terms) has a non-linear and marginal association with the risk of officer injury and resistance from suspects increases the likelihood of officer injury (OR=1.73; 95% CI=1.53-1.97). Model 3 adds the two covariates representing departmental policies that restrict OC or CED usage to defensive resistance or greater. The results are substantively the same as those reported in the baseline model and indicate that these department policies are not significantly associated with the risk of officer injuries nor do they effect the associations between individual case characteristics and the likelihood that officers will experience an injury.

The models estimated in Table 5-3 for suspect and officer injuries indicate a substantial proportion of the error structure in these injuries occurs via between-agency variation. This suggests that there may be distinct heterogeneity in the agency-level mechanisms associated with injuries to suspects and officers. To investigate whether unmeasured departmental differences can overwhelm the associations between individual case characteristics and injury outcomes, we estimated the models specified in equation (2) that include fixed-effect terms

(dummy variables) for each agency. This method simply removes the average difference between agencies. The results from these models are displayed in Table 5-4. For ease of exposition, the department-level covariates are not displayed. Adjusting for the estimated average departmental differences does not materially change the substantive conclusions regarding the covariates of suspect or officer injuries, suggesting again that departmental differences do not account for suspect or situational circumstances in explaining the covariates of use of force injuries.

TABLE 5-4 Agency Fixed-Effects Estimates of Suspect and Situational Covariates of Suspect and Officer Injury

	Suspects			**Officers**		
	Model 1 (n=18,168)			Model 2 (n=17,003)		
Variable	*OR*	*95% CI*	*p-value*	*OR*	*95% CI*	*p-value*
Physical force	1.33	1.22-1.45	<.001	3.57	3.12-4.09	<.001
OC	0.33	0.30-0.37	<.001	1.21	1.07-1.37	<.001
CED	0.41	0.37-0.46	<.001	1.01	0.87-1.17	0.88
Resistance	1.23	1.14-1.33		1.76	1.56-1.99	<.001
Sex (1=male)	2.26	2.04-2.52	<.001	1.16	1.02-1.33	0.02
White (v. others)	1.19	1.10-1.28	<.001	0.81	0.74-0.89	<.001
Likelihood Ratio (X^2):	2,808*			1,617*		

Note: Fixed effects for department-level differences.
Likelihood Ratio (X^2) = test of model fit *p<.001.

Limitations

It is worth noting that estimating multilevel models on observational data in this context imposes some heroic assumptions on the structure of the correlation between individual and departmental-level attributes. In effect, these models assume that the error structure at the departmental-level is independent and distinguishable from situational contexts (suspect and officer) of force encounters or that the average differences between departments occurs independently of individual case features such as ethnicity, SES, prior criminal history, etc. Given that use of force cases are not allocated randomly to police agencies, and that there

exists a limitless number of departmental, social, economic, and political differences (e.g., income level, ethnicity, housing practices, the type of police hiring and training, etc.) that are likely correlated with differences in the selection mechanisms by which individual officers and suspects are more or less likely to be exposed to force and injuries, it is reasonable to suspect that multilevel models such as these will never realistically estimate a unique agency-level effect.[27] Although the department policies are occurring at the departmental level (level 2) and could have been an important source of the variance in the group variation, we have only 12 agencies and over 20,000 cases, making it questionable whether partialing out these policies as group-level (random effect) coefficients separately from individual case features is a powerful enough test of departmental level mechanisms. In fact, when we included these two department level covariates (CED and OC policies) as fixed-effects estimates, they shrunk the variance in the random effect intercept by only 3% (from 0.46 to 0.43) for injuries to suspects and only 2% (from 0.27 to 0.25) for injuries to officers, suggesting that including these variables contribute little to the explained variation between agencies.

SUMMARY AND CONCLUSION

These analyses examined the relationship between individual, situational, and agency-level features of use of force cases and the likelihood of injuries to suspects and officers. Using data from 12 local law enforcement agencies representing more than 25,000 use of force incidents, we estimated multilevel and fixed effects logistic regression models to determine predictors of injuries. While controlling for the use of less lethal weapons (OC spray and CEDs) in force encounters, we found that the use of physical force (hands, feet, fists) by police increased the odds of injury to suspects by more than 50 percent and substantially (by a factor of 3) increased the chances of injury to officers. Conversely, the use OC spray or CEDs

[27] The same also could be argued concerning most neighborhood-level studies that attempt to estimate group effects separate from individual-level effects. Unless there is an assignment mechanism that is independent at the (group) neighborhood-level, these models do not provide a causal explanation of covariance at the group-level (Berk, 2003).

decreased the probability of injury to suspects by 65 and 70 percent respectively. Injuries to officers were unaffected by the use of CEDs, while the odds of officer injuries increased somewhat (by about 21 percent in the 12 agency models) when OC spray was used.

The multi-agency findings regarding CEDs and their effect on injuries were largely consistent with the single agency findings. In Miami-Dade and Seattle, CED use reduced the likelihood of injury to suspects. Among officers, CED use was unrelated to injuries in Seattle and Richland County, South Carolina, while the use of CEDs reduced the odds of officer injuries in Miami-Dade. Overall, CED use has been shown to reduce the probability of injuries to suspects across the 12 agencies in the combined analysis and in two out of the three agencies whose data were analyzed independently. Likewise, the relationship between OC spray and suspect injuries in the multi-agency analysis is consistent with the injury reduction finding in Richland County; in Seattle, OC spray had no effect on suspect injuries, while the Miami-Dade Police Department does not issue OC spray.

The finding on OC spray and its relationship to officer injuries is puzzling and is inconsistent with the single agency analyses. In Richland County, the use of OC spray reduced the odds of injury to officers, while in Seattle, it had no effect in either direction. It is possible that some characteristic of OC spray cases increases the chance of officer injury in a manner that differs from CED cases, although the literature reports similar rates of effectiveness (70-80%) among the two less lethal force options (Kaminski, Edwards, & Johnson, 1999; Ready, White, & Fisher, 2008). Further research is needed to better understand how the use of OC spray may differ from the use of CEDs and why one but not the other is associated with an elevated risk of injuries to officers.

A final point bears mentioning. With some of the data sets examined in the multi-agency analysis, we were unable to determine whether an injury reported to a suspect was the result of a puncture by a Taser barb. Where the type and cause of injury were available, we coded minor Taser barb punctures as non-injuries so as not to confound the injury analysis. As a

result, the multi-agency suspect injury findings are conservative because the data probably contain cases where the injury reported was the minor Taser barb puncture. Had we been able to identify and remove all such cases, the reductions found in the probability of suspect injury associated with the Taser likely would have been even greater.

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SECTION 6

LONGITUDINAL ANALYSIS

After reviewing the data available for the multiagency analysis, two data sets – Austin, Texas and Orlando, Florida – were identified as potentially amenable to a longitudinal analysis for the purpose of examining how the introduction of CEDs into an agency subsequently affected injury outcomes in use of force encounters. The question to be addressed in this analysis is whether equipping officers with CEDs reduced injuries to officers or citizens compared to injury levels before CEDs were put into use.

Quasi-Experimental Approach for Assessing the Effect of CEDs on Injuries

Our multiagency analysis found substantial differences in the likelihood that force incidents will result in injuries if a non-lethal weapon (OC or CED) was used. At the same time, a significant proportion of individual force incident differences in the likelihood of suspect or officer injury is characterized by between-agency differences. The cross-sectional multiagency comparison was designed to control for differences between agencies, but it was not designed to assess the overall agency-level effect of the deployment of non-lethal technologies on use of force cases. This raises the question of whether agency-level differences are merely proxies for unaccounted structural differences between the cases sampled in each of these areas. For example, it is possible that law enforcement agencies with a higher prevalence of youthful residents under the age of 25 are more likely to experience problems with suspects and have force incidents that transpire into more serious events. Recognizing that it is not possible to know all the important structural sources of differences between agencies, we focused a subsequent analysis on the pre-post changes in injuries that occurred within departments that recently deployed non-lethal technologies and had data available for periods before and after the implementation of these devices.

The Austin Police Department (APD) classifies injuries as minor, moderate, or major. The APD data that we received also contained a brief narrative description of the injuries as well. All injuries to suspects were initially coded by the APD as minor (e.g. bruises, cuts, scrapes, strains, or complaint of pain with no visible injury). Injuries to officers were similarly coded by the APD, although several officer injuries were coded as moderate or major when the narrative described what would have been classified as a minor injury to a suspect (e.g. swollen finger, minor cuts to face). For the purpose of this longitudinal analysis, though, any injury classification (minor, moderate, or major) was considered an injury. The Orlando data also contained a brief narrative description of injuries to officers and suspects. Again, any injury described (almost all were minor scrapes, cuts, or bruises) was considered an "injury" for the purpose of the present analysis.

Sample description

Table 6-1 provides descriptive statistics for the pre- and post-CED intervention periods for the Orlando and Austin police departments. The Orlando data comprise 4,222 use-of-force incidents aggregated to 108 months - a nine-year period (1998 – 2006). The intervention (CED

TABLE 6-1 Pre-Post CED Summary Statistics for Orlando and Austin

	Orlando			**Austin**		
	Pre-CED	*Post-CED*		*Pre-CED*	*Post-CED*	
Variable			*Total*			*Total*
# Months	61	47	108	30	30	60
# Force incidents*	1,891	2,331	4,222	3,701	2,895	6,596
# CED uses	1	1,467	1,468	212	632	844
Rate of CED use	.0005	.63	.35	.06	.22	12.8
Avg. # CED uses per month	.02	31.21	13.59	7.07	21.07	14.07
# Suspects injured	929	875	1,804	1,301	952	2,253
Avg. # suspects injured per month	15.23	18.62	16.70	43.37	31.73	37.55
Rate of suspect injury	.49	.38	.41	.35	.33	.34
# Officers injured	327	154	481	774	529	1,303
Avg. # officers injured per month	5.36	3.28	4.45	25.80	17.63	21.72
Rate of officer injury	.17	.07	.11	.21	.18	.20

*The Orlando data are comprised of separate incidents of use of force whereas the Austin data are not completely incident-based (an unknown number of records or rows of data from the same incident are treated as though they are independent use-of-force incidents). Thus, the "rate" calculations for Austin are not directly comparable to those for Orlando and the former must be interpreted with caution.

use) begins February 1, 2003 (the 62nd month), with 21 CED deployments reported in the first month (there was a single prior CED use reported in August 2002). Thus, in Orlando, there were 61 pre-intervention observations and 47 post-intervention observations. CEDs were deployed 1,467 times during the post-intervention period for an average of 31.2 deployments per month. The rate of usage was .63 or 63 deployments per 100 use-of-force incidents. A total of 1,804 suspects were injured with just over half (51%) injured during the pre-intervention period. The average number injured per month rose from 15.2 to 18.6 pre- to post-intervention. The rate of suspect injury, however, decreased from .49 to .38 during this time. A total of 481 officers were injured, with 68 percent injured during the pre-intervention period. The average number injured per month declined from 5.36 to 3.28 pre- to post-intervention, and the rate of injury dropped precipitously from .17 to .07.

The Austin data consist of 6,596 force incidents[28] aggregated over 60 months (2002 – 2006), with the pre- and post-intervention observations consisting of 30 months each. However, unlike Orlando, there is no abrupt intervention; rather, CEDs were phased into the department. In 2003, 160 CEDs were issued department wide. An additional 750 were purchased in February 2004 and by June of that year all patrol officers were fully trained and issued the devices. Thus, we choose July 2003 (the 31st month) as the intervention point. An examination of the data, however, shows substantial CED activity prior to the 31st month. Specifically, 212 (25%) of the CED deployments during the pre-intervention period, with the majority of those (84%) occurring during the previous nine months. Regression estimates of the impact of CEDs on injury rates, therefore, will be conservative.

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[28] These data are actually a mix of incident-level data (e.g., a single record or row of information for a given force incident involving a lone officer and a single suspect) and multiple records or rows of data for the same incident (e.g., those involving multiple officers and/or suspects). Unfortunately, we are unable to identify whether multiple records or rows of data belong to the same or different incident(s). Thus, the reported counts and the rate calculations for Austin are not directly comparable to those for Orlando, and the former must be interpreted with caution.

As shown in Table 6-1, the majority of the 844 Austin CED deployments (75%) occurred during the post-intervention period, for an average of 21.1 deployments per month. The rate of usage was .22 or 22 deployments per 100 use-of-force incidents. A total of 2,253 suspects were injured, with 58 percent injured during the pre-intervention period. The average number injured per month increased from 31.7 to 37.6 pre- to post-intervention, though the rate of suspect injury decreased slightly from .35 to .33 during this phase. A total of 1,303 officers were injured, with 60 percent injured during the pre-intervention period. The average number injured per month increased from 17.6 to 21.7 pre- to post-intervention, and the rate of injury increased from.18 to .20.

Time trends

Figures 6-1 and 6-2 plot the monthly time trends of total use of force incidents and the usage of CEDs in Orlando, FL and Austin, TX during the period of observation. In addition to plotting the number of events in each month, these figures also graph the median splines (smoothers) for a visual depiction of each time series. It is clear from a visual examination of these figures that there was an initial upward trend in use of force incidents in Orlando, FL shortly after the full-scale deployment of CEDs (starting in month 62), followed by some oscillation. However, the overall trend in force incidents is higher in Orlando after CEDs were deployed. In contrast, Figure 6-2 for Austin indicates a temporal pattern of declining monthly incidents of use of force over the entire observation period – with a spike in CED usage after their adoption (starting in month 31). These graphs suggest that it is important to take into account these time trends in assessing what effect (if any) the adoption of these non-lethal technologies have on the likelihood of officer and suspect injuries in use of force incidents. For example, it would be easy enough to estimate a linear trend for Orlando, FL and suggest that CEDs were associated with a higher number of injuries, but this finding would be driven by the overall linear increase in total force events. It would be just as easy to estimate a linear trend for Austin, TX and suggest just the opposite. In our subsequent analysis, we take these trends

into account in developing our framework for assessing whether the adoption of these technologies is associated with the rate of injuries.

FIGURE 6-1 Monthly Incidents of Force and CED Use in Orlando, FL

FIGURE 6-2 Monthly Incidents of Force and CED Use in Austin, TX

Analytic strategy

To assess the effect of adopting CEDs on the number of reported injuries to suspects and officers, we estimated a time series model, where y_t is the number of reported injuries for officers or suspects in a given agency (Orlando or Austin) that is indexed by time point (month). We let the full adoption of CEDs during the observation period at month *t* (where *t*=1,…108 for Orlando, FL; 1,…60 for Austin, TX) denote the timing of the intervention treatment. Since we have counts of the total reported use of force incidents in each month, we model injury counts as a function of both the total counts of force and the adoption of CEDs with a Poisson distribution ($y_t \sim Poisson(\lambda_t)$). Thus, the injury rate (λ_t) for each police agency (*Orlando or Austin*) during a given month (*t*) is modeled according to the following form:

$$\log(\lambda_t) = \log(force_t) \times \beta(CED_t) + \sum_{k=1}^{4} \beta_k NS_k(t) + \varepsilon_t \qquad (3)$$

The model expressed in equation 3 for the monthly injury rate (λ_t) simply implies a counterfactual - that the injury rate in each agency after CEDs become fully deployed is proportional to what the injury rate would have been in that area had the CED not been implemented. We include the natural log of the number of force events on the right hand side of the equation and constrain its coefficient to equal 1 so that the count of injuries is equivalent to a rate of injuries per force event in a given month (t).[29] As previously noted in Figures 6-1 and 6-2, there is a clear trend in the use of force rates over time in both cities, suggesting that it is important to control for these time trends. Therefore, the term $\sum_{k=1}^{4} \beta_k NS_k(t)$ models the time trend over the monthly observation periods, where $NS_k(t)$ denotes the components of a natural cubic spline with four knots.[30] We also substituted the natural cubic spline term with traditional linear terms $\alpha_i + \sum_{k=1}^{i} \beta force_k(t)$, such that the time trend is modeled according to the overall monthly average plus individual year parameters (fixed effects). The results from the linear model were substantively similar.

Results

The results from each model estimating the pre-post intervention effect of adopting CEDs on suspect and officer injuries (for Austin, TX and Orlando, FL) are displayed in Table 6-2. These results are presented in terms of incident ratios (IR) ($\exp^B$) or the expected average monthly rate of injury in the post-CED adoption period relative to the prior-CED adoption period. Models 1 and 2 show the results for suspect and officer injury rates in Orlando, FL. The results

[29] The error structure in equation 3 (ε_{it}) is assumed to be random and normally distributed and independent since the time trend was accounted for in the model. We tested for overdispersion (excessive variation in counts not explained by the Poisson model) by comparing the model fit to that generated by a gamma distribution from a negative binomial variation of the Poisson. We found no substantial improvement in model fit (see Berk & MacDonald, 2008 for a discussion).

[30] Thus, this component of the model includes four parameters, β_1, β_2, β_3, β_4. This is similar to including t, t^2, and t^3 to the Poisson regression model in equation (3), but the natural spline is more flexible and avoids potential problems with erratic behaviors at beginning and end points of the monthly observation periods.

for Orlando indicate that the average monthly incidents of suspect injuries after the introduction of CEDs was 0.47 that of what would be expected from the pre-intervention period (95% CI=0.37-0.59). Stated differently, the monthly rate of suspect injuries (per force incident) was reduced by more than half after the full introduction of CEDs. Similarly, officer injury rates during the post-CED deployment period were 0.38 that would be expected from the pre-CED period (95% CI=0.23-0.62). The results for Austin, TX are presented in Model 3 and 4. The full scale deployment of CED devices in Austin was associated with a monthly suspect injury rate that was 0.70 that would be expected from the pre-deployment period (95% CI= 0.55-0.88). For police officers in Austin, TX the injury rate after the full deployment of CEDs was 0.75 that would be expected from the pre-deployment period. Together, these results suggest that a substantial reduction in injuries to officers and citizens in use of force incidents occurred in Orlando, FL and Austin, TX after the introduction of these non-lethal technologies. Specifically, the average rate of injuries for suspects and officers per force incident during the post-CED periods for these cities was 42.5% lower than what one would expect. Importantly, because we model the adjusted total incidents of force in each month and the overall time trends in each city, these associations are not driven by general changes in the application of force by officers.

As a sensitivity test of these models, we replicated the analysis but substituted the pre-post indicator for the adoption of CEDs with a measure of the number of CEDs used in each month. For both Orlando, FL and Austin, TX, each additional application of a CED in a given month was associated with a reduced injury rate. For Orlando and Austin, an additional ten uses of CEDs in a given month was associated with a 9.8% and 9.9% reduction in the average rate of injuries to suspects and officers, respectively. Again, these results suggest that the use of CEDs reduces the odds of injuries to both officers and suspects in use of force cases.

TABLE 6-2 Introduction of CED on Monthly Suspect and Officer Injury Rates

Variable	*IR*	*95% CI*	*p-value*
Model 1 (Orlando, FL: Suspect Injury Rate)			
CED Intervention	0.47	0.37-0.59	<0.001
N= 108			
Likelihood Ratio (X^2)	1311.97*		
Model 2 (Orlando, FL: Officer Injury Rate)			
CED Intervention	0.38	0.23-0.62	<0.001
N=108			
Likelihood Ratio (X^2)	2126.72*		
Model 3 (Austin, TX: Suspect Injury Rate)			
CED Intervention	0.70	0.55-0.88	0.002
N=60			
Likelihood Ratio (X^2)	2598.28*		
Model 4 (Austin, TX: Officer Injury Rate)			
CED Intervention	0.75	0.55-1.02	0.069
N=60			
Likelihood Ratio (X^2)	27.96*		

Note: Controlling natural cubic spline of monthly time series.
Likelihood Ratio (X^2) = test of model fit *p<.001.

SUMMARY AND CONCLUSION

Using data from Austin and Orlando, this analysis modeled pre-post Taser implementation changes in injury rates to officers and suspects involved in use of force events. In both cities, the adoption of the Taser was associated with a statistically significant reduction in average monthly injuries to suspects. After the Taser was adopted as a less lethal alternative for patrol officers in Orlando, the rate of injury to suspects dropped by more than 50 percent compared to the rate of injury before the Taser was put to use. In Austin, suspect injury rates were 30 percent lower after full-scale deployment of the Taser than they were in the pre-deployment period. Reductions in officer injury rates were even greater in Orlando than for suspects; the average monthly rate of injury to officers dropped by 60 percent after the Taser was adopted. In Austin, injuries to officers also dropped – by 25 percent – after the Taser was deployed agency-wide, a reduction that approached statistical significance at p = .069.

Previous analyses with cross-sectional data from multiple agencies showed a reduction in injuries associated with the use of the Taser. This analysis extends those findings and demonstrates that at least in Austin and Orlando, the adoption of the Taser by those cities' police forces reduced injury rates to both officers and citizens. One caveat to our findings is that we did not separately model or analyze cases of rare events such as in-custody suspect deaths. Although overall injury rates dropped after the Taser was adopted in the two cities, our analysis does not rule out the possibility that in-custody deaths remained unaffected or even increased.

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SECTION 7

INTERVIEWS WITH OFFICERS AND SUSPECTS

Although surveys and the analysis of existing data are indispensable methods for evaluating use of force policies and outcomes, a qualitative research strategy is also vital to understanding the dynamics of complex police-citizen encounters involving force. Thus, we conducted a series of interviews with officers and suspects involved in use of force situations to supplement and add context to the quantitative components of the overall project.

Interview Methods

Members of the research team interviewed deputies from the Richland County (SC) Sheriff's Department (RCSD), officers from the Columbia (SC) Police Department, and suspects they arrested and used force to control during the first six months of 2007. The interview protocol was designed specifically to capture officer' and suspects' perceptions of the use of force and suspect resistance. Informed consent forms were reviewed with the subjects and copies were provided at each interview. All participants were told that participation in the interview was totally voluntary and that participation/non-participation would neither help nor harm the participant.

RCSD

The process for conducting interviews with suspects and officers began with the notification of use of force reports. With the RCSD, a deputy assigned to the project hand-delivered a sealed envelope to the members of the research team that contained copies of use of force reports that had been completed during the previous week. Once the reports were received, they were read and reviewed for content and the names of the deputies and suspect(s) were identified. Generally, attempts were made to contact both the deputies and suspects within 48 hours of receiving the use of force reports.

Contact with the deputies was made by telephoning their regional office or the deputy's cell phone to set up an interview time. Interviews were usually scheduled at their respective regional offices before or after roll call. In the RCSD, dayshift roll call was at 6:00 AM and nightshift roll call was at 6:00 PM; therefore, interviews would begin around 6:15 both in the morning and evening and usually lasted about 30 minutes. At the start of each interview, each deputy was asked to read the consent form and to ask any questions the deputy had about the project or the research protocol. Once the deputy completed reading the form, the deputy was told that he or she could terminate the interview at any time and that participation was voluntary. If the deputy agreed to participate, he/she was asked to sign the consent form and the interview was started. The deputy also was provided with a signed copy of the consent form for the deputy's records. If the deputy did not agree to participate, the deputy was thanked for his/her time and the researcher left. Only 5 deputies refused to participate in the study.

Interviews were conducted with 219 officers who responded to 105 incidents, with an average of two officers per incident. Although not all of the officers who participated in the interactions were interviewed, each interaction is represented. The officers were responding to calls for service in 86 of the cases and observed suspicious behavior in 18 of the cases. In 30 cases, prisoners were being transported, 11 cases were the result of a BOLO, and there were 9 cases each that included a vehicle stop and a domestic disturbance call. Other calls included 7 warrant services, 6 calls for assault, 3 calls for a mental person, and 3 car chases. In addition, 24 interviews were conducted with suspects at the Richland County Jail that corresponded with interviews of the officers who had arrested them.

CPD

The process for interviewing CPD officers did not run as smoothly as with the RCSD. First, we attempted to set up a similar protocol for notification of a force event as we had with the RCSD. We arranged to be notified by the CPD within 24-48 hours of when a use of force event occurred and to get a copy of the associated police reports. As the project unfolded,

however, days would go by without contact from our CPD liaison. We would then make contact with our liaison only to be told that no force events had occurred. Given the similar size of the agencies and the similarities between the city and county populations, it seemed to us unlikely that the CPD was recording so few force events. Nonetheless, we continued to make regular contact with the CPD and would get copies of force events from them on a sporadic basis. In most cases, too much time had passed between when a force event occurred and when we received notice of it for us to locate the suspect at the jail. Most suspects had been released before we could interview them, thus accounting for the single completed suspect interview involving a CPD officer.

Like the RCSD, interviews with CPD officers took place at their stations, usually either before or after roll call. Contact was made with the officers by phone and the interviews were scheduled. Officers were provided with the informed consent forms and were asked to sign them if they agreed to be interviewed. In total, 35 CPD officers were interviewed who responded to 27 separate events. Ten of those events involved public order or intoxication offenses, 1 was a drug offense, 4 were criminal domestic violence calls, 2 were traffic stops, 2 were fights or assaults, 3 were calls for suspicious persons, and the remainder involved a variety of different calls or crimes.

Suspects

The protocol for suspects required a different format. All members of the research team were provided with identification cards that allowed them access into (and out of) the Alvin S. Glenn Detention Center (Richland County jail). Once the name of a suspect was obtained from either an RCSD or CPD use of force report, the name was checked at the jail's website to determine if he or she was still incarcerated. The website maintains a daily roster of inmates. If the suspect was no longer in the detention center, no further attempts to contact that individual were made. If the suspect was still in the detention center, a member of the research team would go to the jail and contact the inmate. Whenever possible, initial interviews were

made in as private a setting as possible. Normally, a table in a corner of the general population area was utilized to talk with the inmate. The table was observable by others but far enough away that conversations were private. With the suspects, the consent forms were provided and read to the subjects. Additionally, each part of the consent form was further explained to ensure the complete comprehension of the consent form by the suspect. If the suspect did not wish to participate, the researcher thanked the individual and left. No further attempt to obtain an interview was made. For those who were willing to participate and signed a copy of the Informed Consent Form, the interview began and followed the format on the questionnaire.

All together, 24 suspects were interviewed – 23 from the RCSD and one from the CPD. Ten suspects refused to participate in the study. The number of suspects interviewed was considerably lower than the number of officers interviewed primarily because many suspects had been released from the jail before they could be reached by members of the research team. With the CPD, we often did not get notified of a use of force event until a week or more had passed. Although notification was much quicker from the RCSD, we still found that many suspects had been released within 24 hours of arrest, which precluded us from interviewing them at the jail. Both for reasons of practicality and safety, we decided not to contact or attempt interviews with suspects once they had left the jail.

Qualitative Analysis

The analysis of the data provided by the interviews, observations, and documents was accomplished through an open coding strategy (Strauss & Corbin, 1990). This strategy followed the four guidelines recommended by Strauss (1987): (1) we read the data consistently and specifically for lessons learned, (2) we analyzed the data minutely and with great care, (3) we took notes on emerging themes and constantly assessed new data strings for consistency with these themes, and (4) we did not assume that our themes were complete or exhaustive until all data had been read and analyzed multiple times. The coding process itself required us to move data strings (word, phrases, thoughts) around using the search and cut-and-paste functions of

Microsoft Word. Once themes were identified through this open coding process, we then examined the data strings within them to develop the details of each theme.

Findings

RCSD

According to the RCSD officers interviewed, the suspects' first behaviors included 34 cases of aggressive actions, including fighting, 29 cases of running away, 21 cases of defensive resistance (pushing/pulling against an officer), 13 cases of walking away, 7 cases of suspects with weapons, and 1 attempted suicide. The officers' first behaviors included 24 cases of verbal commands, 23 uses of a Taser, 14 displays of weapons, 13 come-along holds or forceful handcuffing, 12 uses of hands and feet to gain control, and 11 foot pursuits. The suspects' second behaviors turned to mostly aggressive behavior (70%), running away (14%), and defensive or passive resistance (11%). Once resistance was encountered, officers usually opted for the Taser (38%) or fighting with hands and feet (24%). In those cases where suspects exhibited a third resistant behavior, most involved fighting (60%) or running away (35%). Officers who used a third tactic relied heavily on the Taser (50%) or the display/pointing of a firearm (20%).

Several trends from the RCSD data are important to mention. First, there were nine incidents where officers reported that the Taser did not work properly or did not have its desired effect. It is unclear if the problems reported with the Taser were from darts not attaching properly, a cartridge malfunction, or some other problem. Second, there were also reports of multiple Taser hits on a suspect and multiple uses of the Taser in drive stun mode used to control suspects (or based on the suspect's reports – punishment). While these data cannot determine whether the uses of the Taser were or were not appropriate, they suggest that multiple uses or activations of the Taser are not uncommon when the Taser is deployed.

For the most part, officers reported that force could have been avoided if suspects had not been resisting or fighting. They noted that they were well prepared and equipped to handle

encounters that turned violent. In most cases, suspects did not admit to the types of behavior or resistance they were accused of committing. In fact, in the few cases in which both officers and suspects were interviewed concerning the same event, there were significant disagreements on the activities that took place.

Among the 219 officers interviewed, 9 percent reported suffering an injury. Almost all of the injuries reported were scrapes, cuts, or bruises suffered while physically struggling with resistant suspects. Officers also reported that 26 suspects (12%) suffered an injury. As with the officers, most suspect injuries consisted of cuts and abrasions that occurred in the process of officers taking the suspects to the ground or struggling with them while on the ground. Among the 26 reported injuries to suspects, two were dog bites and one suspect was shot in the arm after firing at officers.

Twenty-two interviews were conducted with RCSD suspects at the Richland County Jail that corresponded with interviews of officers who had arrested them. The general trend of the interviews was that the officers used excessive or unnecessary force to subdue the suspects and that, for the most part, the suspects were treated improperly. Interestingly, there were a number of claims that officers used Tasers very quickly in the interaction and several suspects claimed that the officers enjoyed watching them endure the pain. A number of suspects claimed that officers would knee them in the back and kick or punch them after they were in handcuffs. There were also claims that officers used Tasers on suspects after they were handcuffed.

It is to be expected that suspects will tell a different story than the police officer who arrests them. In almost all the cases, the suspects reported that the force the officer used was excessive and that they, the suspects, were not resisting. The officers told us, for the most part, that they used minimal force to control the suspects and did not mention using force after a suspect was under control. Not surprisingly, the officers reported their force was necessary and reasonable.

A typical suspect response came from Case # 0123061, who stated that he was unaware that there was a warrant out for his arrest, and when the police confronted him, he did not resist; rather, the officers "pushed me to the ground and put the cuffs on … they didn't have to do that to me." This suspect said that he was not resisting and that the officers pushed him to the ground unnecessarily. He also said that all the officers had to do was tell him to "quit acting up." His complaint was that the police officers should have told him to calm down and not shove him to the ground. The officers, on the other hand, said the suspect ran away when he was confronted with the warrant and the officers ran after him and tackled him on the ground. The theme of this and many other confrontations is that the suspect states that he did not resist and the officer used too much force on him, while the officers provide justification for the level of force used. As in this case, when the suspect ran, the officers tackled him.

Other scenarios included different explanations for behavior. For example, in Case # 0125062, one officer reported that he observed several traffic violations and that the suspect vehicle sped off and came to a stop, with one suspect running away. The officers reported that the driver attempted to exit the vehicle from the passenger's side with a shotgun. The second officer pointed his weapon at the suspect who dropped the shotgun and complied. The suspect failed to mention the shotgun and only complained that the officers put the handcuffs on too tightly and slammed him around in the back of the transport vehicle. Over and over again, suspects offered radically different versions of the use of force events as compared to the officers interviewed.

CPD

Among the CPD officers interviewed, 35 percent reported defensive resistance (pushing/pulling against the officer, muscle tensing, grasping onto fixed objects) from suspects as the *initial* type of resistance that resulted in the application of physical force. An equivalent percentage – 35% -- stated that suspects exhibited active/assaultive resistance (assault or battery on the officer) in the first instance. Fleeing on foot was the next most common type of

initial resistance offered by suspects. Twenty-four percent of the officers interviewed reported that suspects ran away from them, which caused them to use force initially. Finally, two officers (6%) reported that suspects exhibited or threatened deadly force (gun or knife).

In response to a suspect's initial resistance, most officers (52%) reported using soft empty hand control (grabbing, pulling, pushing, pressure points, joint locks) as their *first* attempt to control the suspect. Another 19 percent stated that they used OC (pepper) spray initially in response to suspect resistance. Five officers (16%) stated that they pointed their firearms at a suspect initially, and 10% used their batons. One officer used hard empty hand control (punches, kicks, knee or elbow strikes) in response to the suspect's initial resistance.

Most officers reported that their initial application of force was effective enough to overcome the suspect's resistance and allow them to gain control. When the initial application of force was ineffective, officers reported escalating their force. Most often this escalation involved the use of OC spray or an increasingly aggressive application of soft empty hand control. One officer's (Case #0912061) responses are representative of this theme:

> After asking him to come to me, he turned around as if he was trying to leave, so I grabbed his wrist. He began to actively resist by pulling away. Since we were near my vehicle, I grabbed him and placed him on the hood of my car so I could get a hold of him. He was able to get up and tried to get away again. I then grabbed him and put him on the ground. He continued to actively resist being arrested; he was fighting with me and elbowing me. We had been fighting for about two minutes or so. The suspect had rolled over onto his belly keeping his right arm underneath. I could not get to his right hand since it was underneath him. I gave him loud verbal commands continually telling him to give up his hands, but he would not comply. Finally, I used my OC spray and he gave up his hands.

In many cases, continued resistance by a suspect and increasing efforts at physical control by the officer ended with the suspect and officer on the ground. Officers use the ground intentionally to assist them in gaining control. Not surprisingly, these cases of ground fighting often result in minor bruises, scrapes, or cuts to both officers and suspects. Among the 35 officers interviewed, 11(31%) received scrapes, cuts, or bruises from contact with the ground. Similarly, 14 (40%) suspects were injured in this manner as well.

Unlike the Richland County Sheriff's Department, the CPD did not issue Tasers to its officers at the time this study was conducted. When asked whether they would have preferred to have another force option available to them, almost every CPD officer interviewed stated that he or she would have preferred to have a Taser. One officer summed up the sentiment of the group when he stated, "[I would have preferred a Taser] so I don't have to get on the ground and fight."

Finally, it is worth noting that three officers reported that OC spray was ineffective. In all three cases, the suspects were either intoxicated or high on drugs. One case (#0913061), in particular, highlights the potential advantages of the Taser over OC spray. In that case, a 6"7" 370 pound man wanted for criminal domestic violence charged a CPD officer with a metal object in his hand. The officer sprayed the suspect with OC spray, but it had no effect. The suspect then retreated to the apartment's kitchen and grabbed a knife. The officers pointed their firearms at him and ordered him to drop the knife, but he refused. The suspect began to cut and stab himself with the knife while the officers waited for another agency to arrive that was equipped with a Taser. After 20-30 minutes of negotiating with the suspect, and after he had cut himself more than 100 times, officers from the South Carolina Law Enforcement Division (SLED) arrived and Tasered the suspect. The CPD officer described what happened next: "SLED shot him with the Taser and it had an instant effect on him. We were able to cuff him. [My] pistol was for my safety. The Taser was perfect [for that situation]".

SUMMARY AND CONCLUSION

During the first six months of 2007, officers from the Richland County Sheriff's Department (n=219) and the Columbia Police Department (n=35) were interviewed following use of force encounters with suspects. Likewise, 24 suspects involved in these encounters were interviewed as well. Although all levels of force and resistance were represented in the data, most force used was relatively low level, soft empty hand control and most resistance encountered was defensive in nature. These findings are consist with the extant literature that

also reports most force and resistance as being low level (see Garner, Maxwell, & Heraux, 2002).

The low levels of force and resistance reported, however, belie the probability of injury that was observed when officers struggled to bring suspects under control using physical control tactics. The vast majority of injuries recorded in both agencies occurred as officers and suspects struggled on the ground. However, the differences between the two agencies in this regard were striking. The RCSD equips most of its deputies with Tasers. Perhaps not coincidentally, the RCSD deputies who were interviewed collectively reported fewer injuries to themselves and suspects resulting from ground fighting than did the CPD officers. In contrast to the RCSD, the CPD does not issue Tasers to its officers, and 31 percent of them reported receiving cuts, scrapes, and bruises from wrestling with suspects on the ground. The prevalence of ground-fighting related injuries among the RCSD officers was considerably lower (<9%), as were injuries to suspects caused by contact with the ground. Moreover, in only three instances did RCSD officers report that a suspect was injured by the Taser beyond the minor puncture wounds associated with superficial skin penetration of the barbs. In two cases, suspects sustained bruises or scratches from falling after being Tasered, and in one case, a suspect suffered a lacerated finger (minor) from a Taser barb that struck his finger at an angle.

The CPD officers interviewed were aware of the potential advantages that the Taser offered in avoiding physical struggles with suspects, and almost all of them stated that they would have preferred to have the Taser available to them as an option. Although the injuries that they and the suspects whom they sought to control were relatively minor, they were not insignificant and some (if not most) could have been prevented had the Taser been used rather than hands-on control tactics.

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SECTION 8

IMPLICATIONS FOR POLICY, TRAINING, AND FUTURE RESEARCH

In this section, we discuss the implications of our findings for policy and training. We discuss the factors that we found to be correlated with injuries to police and citizens and what those findings mean for police practices. Because of their controversial nature and widespread use, we discuss CEDs in detail and make recommendations, based on our findings, for whether or how they should fit into the range of less lethal force alternatives available to the police. Finally, we set out an agenda for future researchers to consider that will help address some of the questions left unanswered by this study.

Correlates with Injuries

Physical Force

Our findings clearly show that the use of physical force and hands-on control increase the risk of injury to officers and citizens. In Richland County, South Carolina, soft empty-hand control significantly increased the odds of injury to officers, while hard empty hand control increased the risk of injury to suspects. In Miami-Dade, both types of physical force increased the risk of injury and to both officers and citizens. In Seattle, the use of physical force increased the risk of injury to officers but *not* to citizens, while the multiagency analysis showed an increased risk of injury to citizens and *especially* to officers associated with physical force. This increased risk was not trivial. When controlling for the use of CEDs and OC spray in the multiagency analysis, using physical force increased the odds of injury to officers by more than 300 percent and to suspects by more than 50 percent.

Suspect Resistance

Not surprisingly, increasing levels of suspect resistance were associated with an increased risk of injury to officers and suspects. The increased risk of injuries was especially acute for officers. In Richland County, active aggression and threats of deadly force increased

the odds of officer injury (by more than 100%), while passive and defensive resistance did not. Actively aggressive resistance increased the odds of suspect injury as well. In Miami-Dade County, the likelihood of officer injury increased 160 percent with each unit increase in suspect resistance, while a unit change in suspect resistance in Seattle increased the odds of officer injury by 80 percent. The likelihood of suspect injury associated with higher levels of resistance increased at a much lower rate in Miami-Dade than the likelihood of officer injury, and the odds of suspect injury in Seattle were unchanged with increased levels of resistance. These findings suggest that officers, rather than suspects, bear the brunt of the increased risk of injury when suspects resist at higher levels.

Pepper spray

The findings regarding OC spray suggest that at least for suspects, the use of OC spray reduces the probability of injury. In Richland County, the use of OC spray reduced the odds of suspect injury by 70 percent but had no effect on officer injuries. In Seattle, the use of OC spray had no effect on injuries to either officers or suspects. However, in the multiagency models, the use of OC spray reduced the probability of injury to suspects by 70 percent, which was even more than the injury reduction observed with CEDs (see below). For officers, the use of OC spray increased the probability of injury by 21 to 39 percent (depending upon the model). This finding was unexpected and suggests that cases involving the use of OC spray differ from those involving CEDs in ways that were not accounted for in the models. Further research is needed on the temporal ordering of force and resistance and how officers choose to use OC spray versus CEDs.

CEDs

With the exception of Richland County where its effects were non-significant, the use of CEDs substantially decreased the likelihood of injuries to suspects. In Miami-Dade, the odds of a suspect being injured were almost 90 percent lower when a CED was used than when it was not. Similarly, the odds of suspect injury went down (by almost 50%) when CEDs were used in

Seattle. The multiagency models also show a reduction in suspect injuries associated with CED use. Across 12 agencies and more than 24,000 use of force cases, the odds of a suspect being injured decreased by almost 60 percent when a CED was used. In Richland County, SC Seattle, and in the multiagency models, the use of the Taser had no effect on the probability of officer injuries, while in Miami-Dade, officer injuries were less likely to have occurred when the Taser was used. Overall, the injury findings related to CEDs were robust across agencies and across time. Controlling for other types of force and resistance, the use of CEDs significantly reduced the probability of injuries.

The adoption of CEDs by the Orlando, Florida and Austin, Texas police departments reduced injuries to suspects *and* officers over time. Pre-post injury analyses revealed lower injury rates for both groups after the Taser was introduced in the two agencies as a less lethal force option. These findings held even though use of force rates *increased* in Orlando and *decreased* in Austin over the study period.

Other situational and individual case characteristics

Aside from officer force and suspect resistance variables, few other factors were correlated with injury outcomes. In the Miami-Dade models, which included suspect gender as a variable, male suspects were twice as likely as females to be injured in a use of force event. The same held true for male suspects in the multiagency models. Also in the multiagency models, the presence of a male suspect slightly increased the risk of injury to officers when compared to female suspects. In Seattle, officer gender was available for inclusion in the models, and female officers proved more than twice as likely as male officers to be injured. Given the average size and strength differential between males and females, as well as the greater involvement of males in crimes of violence, none of these findings is surprising.

Placement of OC Spray and CEDs on a Linear Force Continuum

In light of the findings from the present study on the relationship between various police use of force options, suspect resistance, and injuries to police and citizens, the placement of OC spray and CEDs on a linear force continuum (used by more than half of the agencies surveyed) should be carefully considered. Research on the use of force by police, including the results from the current study, consistently shows that most use of force encounters involve no more than defensive efforts by suspects to resist physical control. A typical resistance scenario involves an initial refusal by a suspect to comply with police commands followed by the suspect pushing or pulling against an officer's attempt to physical gain control and apply handcuffs. According to our interviews with officers, many of these "wrestling matches" end up with the suspect and officer on the ground and the officer trying to use the ground for leverage. The single and multiagency injury models, though, clearly show the increased risk for injury that such physical struggles carry with them. Furthermore, although suspects are injured more frequently than officers in use of force encounters, the increased risk for injury associated with soft empty hand control attempts is borne disproportionately by the police.

In juxtaposition to these observations, our findings consistently show a significant reduction in the risk of injury to suspects when CEDs or OC spray is used. This should not be surprising, as these weapons allow officers to control suspects from a distance without engaging in the hand-to-hand struggles that typically cause injuries. However, these weapons are not painless or risk-free. Tasers barbs often cause small punctures or superficial burns, and OC spray causes an intense burning sensation and irritation of the skin and mucous membranes. In very rare cases, people have died after being pepper sprayed or shocked with a Taser, although no clear evidence exists that the weapons themselves caused the deaths (National Institute of Justice, 2008; Petty, 2004). Also included in the risk/benefit calculus is the observation from our data that most injuries, either to officers or suspects, are minor and involve muscle strains, bruises, small cuts, or scrapes.

According to the survey results, 45 percent of agencies allow for the use of OC spray to overcome passive resistance (suspect sits down and refuses to comply with police commands), while another 20-30 percent of agencies authorize the use of a CED under these circumstances. When resistance increases to the typical defensive level (suspect tenses and pulls against officer's attempt at handcuffing), 82 percent of agencies authorize OC spray and about 60 percent allow for the use of a CED. Once the suspect's resistance level becomes threatening or assaultive, CED authorization increases to about 70 percent, while OC spray remains at about 85 percent.

If injury reduction is the primary goal, then agencies that authorize OC spray and/or CEDs to overcome defensive resistance are clearly at an advantage based upon the results from the current study. Both of these less lethal weapons help prevent or minimize physical struggles that cause injury (albeit relatively minor ones) to officers and citizens. Although both cause pain, they reduce injuries, and based on the present state of the medical research, death or serious harm associated with their use is extremely rare. In that sense, CEDs and OC spray are safe, and both are similarly effective at reducing the probability for injury. Both should be authorized as possible response alternatives to defensive (muscle tensing, struggling to escape physical control, fleeing on foot) or higher levels of suspect resistance. This recommendation not only is supported by our findings and observations about injuries but is presently followed by the majority of agencies that responded to the national survey.

Policy and Training Issues Related to CEDs

The proliferation of CEDs in law enforcement agencies nationwide suggests that agencies see value in investing in this less lethal technology. At the incident level in our data, CEDs were used far more often (4-5 times more often) than OC spray among agencies that equipped their officers with CEDs and were sometimes used at rates that exceeded soft empty hand control. Unlike OC spray, CEDs do not require post-use decontamination and do not carry the risk of accidental overspray or "blow back" that often occurs when pepper spray is used.

However, they do require the removal of prongs and the potential for an unintended shock of a police officer. Even with these concerns, they are rapidly overtaking other force alternatives when resistance is encountered. Although the injury findings suggest that the substitution of CEDs for physical control tactics may be beneficial in many cases, their ease of use and popularity among officers (recall that every CPD officer interviewed longed for a Taser) raise the specter of overuse.

The possible overuse of CEDs has several dimensions. First, CEDs can be used too often, that is, at inappropriately low levels of suspect resistance. This problem can be managed with policies, training, monitoring and accountability systems that provide clear guidance (and consequences) to officers regarding when and under what conditions CEDS should be used and when they should not be used. In addition to setting the resistance threshold appropriately – our recommendation is to use defensive resistance – good CED policies and training should require that officers evaluate the totality of the circumstances before using a CED, which would include the age, size, gender, apparent physical capabilities, and health concerns (i.e. obviously pregnant women) of suspects. In addition, CED policies and training should prohibit the use of CEDs in the presence of flammable liquids or in circumstances where falling would pose unreasonable risks to the suspect (elevated areas, adjacent to traffic, etc.). Finally, policies and training should address the use of CEDs against persons who are controlled (e.g. handcuffed or otherwise restrained) and should either prohibit such uses outright or limit them to clearly defined, aggravated circumstances. [31]

In addition to being used too often, CEDs can be used too much. Reported deaths in association with CEDs often involve multiple activations of a Taser (more than one Taser at a time) or multiple 5 second cycles from a single Taser. In addition to having a very low rate of serious injury in epidemiological studies, controlled medical trials have shown the Taser to be

[31] See the PERF (2005) Conducted Energy Device Policy and Training Guidelines for guidance on this and other CED-related issues.

safe on healthy adult volunteers for exposures of up to 15 seconds (Dawes, Ho, Johnson, Lundin, & Miner, 2007a; Dawes, Ho, Johnson, Lundin, & Miner, 2007b). Thus, CED policies should require officers to assess continued resistance after each standard cycle and should limit the CED to no more than 3 standard cycles (15 seconds) of total activation time against the same person. Following the deployment of a CED, the suspect should be carefully observed by officers for signs of distress and should be medically evaluated at the earliest opportunity.

Directions for Future Data Collection and Research

An important secondary finding from this study was the lack of utility and uniformity in how use of force data are collected by law enforcement agencies nationwide. The ability of researchers to examine important use of force-related questions depends heavily on the availability of useable data. Although we are greatly appreciative of the agencies that shared their data with us, far more agencies were surveyed than were unable to provide data, either because the data were not collected or because they were not exportable or useable for research purposes. Even the data that we obtained were limited in scope and could not readily be combined with data from other agencies because they lacked a common architecture or set of definitions.

The use of force is among the most controversial of all policing activities. It has and will continue to be the subject of much research and evaluation, which could be accomplished more efficiently and effectively with more and higher quality data than are currently available from most agencies. Voluntary efforts by the IACP to encourage member agencies to collect and report use of force data have had little impact on data quality or availability. Rather than a voluntary request by a membership organization, a federal incentive is needed for agencies to collect use of force data using a common set of data elements and definitions to define what information is captured. As a model, section 1906 of the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act provided $7.5 million dollars in NHTSA grants to states that enact and enforce laws that prohibit the use of racial profiling in traffic law enforcement and that

collect and allow public inspection of statistical information regarding the race and ethnicity of the driver and any passengers for each motor vehicle stop in the state. Congress, with advice from the National Institute of Justice, could fund a similar grant program to state or local law enforcement agencies that collect and make available for research purposes data on the use of force by police. In the meantime, an effort by NIJ to develop and field test among volunteer agencies a use of force data collection protocol would provide useful data from a select number of agencies and a model of how data collection and analysis can assist with agency policies and training, as well as providing critical information to the research community. The findings and results from our study have uncovered a variety of questions concerning the use of force, CEDs and injuries that must be addressed in the future.

There are potentially many agency-level influences on the use of force and injuries that still need to be evaluated. Our ability to model these influences was limited by data constraints discussed previously. First, do policies matter? The components of a use of force policy on CEDs should include under what threat level the tool can be used, against whom, how many times, duration, and what to do when it appears not to be working as expected. On the surface, differences in these components and policies should result in different rates of suspect compliance and injuries. However, we need to explore, with proper data, the real differences these policies and components make. As noted above, such an analysis would require proper data elements collected from a variety of agencies with different policy components. Second, CED training is a major part of any implementation program. While the manufacturers of CEDs suggest a training curriculum and some manufacturers develop and provide training, there are no real standards that agencies must follow before issuing CEDs to officers. As a result, there is no consensus on what training should be required, what it should encompass, or what its purpose should be beyond device familiarization.

Officer training varies from limited exposure to a CED to scenario-based training where multiple weapons and other tools, including the CED, are available to deal with a

simulated threat. The patterns of use may differ among the officers and agencies that are trained differently, but research to identify possible differences has not been conducted. Another important question that has not been resolved is whether officers provided with CEDs should be shocked with the device during training or what effect such exposure may have on an officer's use of a CED. The National Survey indicated that 46% of agencies that issue CEDs require officers to experience the weapon's effects. It is unknown whether this aspect of training makes a difference in the use of a CED.

We noted above that CEDs can be used too much and too often. A critical research question focuses on the over-reliance of the CED. During our interviews with officers and trainers, we heard comments that hinted at a "lazy cop syndrome." That is, some police officers may turn to a CED too early in an encounter and may rely on a CED rather the officer's skills in conflict resolution or even necessary hands-on applications. Just as we have seen research on the sequence of events during use of force situations, we need to investigate how threats are perceived by officers who have CEDs compared to officers who do not have them. Additionally, it is important to determine when during an encounter an officer deploys the CED.

Another important CED-related investigation would be a case study of deaths in custody when the use of a CED was involved and a matched sample of deaths in custody when a CED was not involved. Advocacy groups argue that CEDs can cause or contribute to suspect deaths. Although the medical research to date does not confirm such claims, the subjects in CED experimental settings have all been healthy people in relatively good physical condition and who have not been under the influence of drugs or alcohol. Obviously, there is no ethical way to expose overweight suspects who have been fighting and/or using drugs to the effects of a CED, so an examination of cases where similar subjects lived and died might shed some light on the reasons for the deaths. The argument that is made by law enforcement is that most if not all of the subjects who died when shocked by a CED would have died if the officers had controlled and arrested them in a more traditional hands-on fight. At this point, the argument is

rhetorical, and research is needed to understand the differences and/or similarities in cases where suspects lived and suspects died in police custody, including deaths where a CED may or may not be involved.

Finally, as we have reported, female officers in Seattle were more than twice as likely as male officers to be injured. Perhaps the finding in Seattle is an anomaly, but it needs to be investigated further. While differences in average physical size and strength could possibly explain why these differences in injuries occurred, more research is necessary to determine if the finding is generalizable and if so, why women are injured more frequently than men. In addition, other officer characteristics and circumstances, including age, training, experience, conditioning, fatigue, assignment, and call for service, among others, should be looked at as variables that could explain differences in injuries. Unfortunately, these variables are not readily available in agencies' databases.

We have presented only a few ideas concerning future research on use of force generally and CEDs specifically. Undoubtedly, others would surface if high quality data were available from many different types of law enforcement agencies. Current efforts to understand injuries and mitigate the harm associated with the use of force by police are hamstrung by a lack of data. The best way to get those data is for Congress to fund a grant incentive program that would be administered through a branch of the Justice Department such as BJS or NIJ. Agencies could apply for grant funds to build the systems (both human and technological) necessary to collect use of force data, which then would be used to support research and analysis aimed at reducing the need for and harmful consequences of police-citizen violence. A panel of experts could identify the appropriate data elements to be collected, and a common software platform could be developed for data entry, storage, and transmission to a research team funded to advise agency participants, audit the incoming data, and create a publicly available and non-proprietary dataset for research purposes. Such a strategy would result in a large-scale data source that could be maintained and updated regularly as new use of force

technologies came online. This modest proposal is both affordable and politically and legally practicable. Most importantly, it would spur new and better research on how to reduce the harm that frequently occurs when police use force to prevent or overcome suspect resistance.

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APPENDIX A

Focus Group Participants

First Focus Group: Tampa, FL, January 20, 2006

First Name	Last Name	Organization
Stephen	Bucklin	Lakeland Police Department
Randy	Butsch	Sarasota County Sheriff's Office
Anthony	Carr	Manatee County Sheriffs Office
Kyle	Cockream	Hillsborough County Sheriff's Office
Mark	Dekle	Temple Terrace Police Department
William	Dixon	Manatee County Sheriffs Office
Ron	Hartz	St. Petersburg Police Department
Mikel	Hollaway	Sarasota Police Department
Ben	McBride	Clearwater Police Department
Ron	Pasto	Pinellas County Sheriffs Office
Eric	Pedersen	Orlando Police Department
Ronald	Sudler	Clearwater Police Department
Mark	Stephens	Temple Terrace Police Department
William	Tokajer	Bradenton Police Department

Second focus Group: Washington, D.C., March 10, 2006

First name	Last name	Organization
Kim	Dine	Frederick Police Department
Mark	Warren	Baltimore County Police Department
Steve	Edwards	Bureau of Justice Assistance
Michael	Dunne	Arlington County PD
Steve	Hudson	Prince William County PD
Dallas	Pope	Talbot County Sheriff's Office
Tom	Winebrenner	Frederick County Sheriff's Office
Kristan	Trugman	U.S. Capitol Police

Third Focus Group: Washington, D.C., May 5, 2006

First name	Last name	Organization
Kara	Kerr	Prince George's County Police Department
Steve	Edwards	National Institute of Justice
Kim	Dine	Frederick Police Department
David	Anderson	Montgomery County Police Department
Tim	Richardson	Fraternal Order of Police
Michael	Dunne	Arlington County PD
Tom	Winebrenner	Frederick County SO

APPENDIX B

Use of Less Lethal Force Survey

POLICE EXECUTIVE RESEARCH FORUM

Use of Force Survey

ID NUMBER

Thank you for participating in PERF's NIJ-funded study on use of force. Your responses will help us understand department practices as they pertain to use of force and the challenges associated with this critical law enforcement issue. All department responses will be kept confidential. No department will be linked to its responses in any report.

We appreciate your contribution to this very important project.

Instructions:

- If you have any questions regarding the survey, please call or e-mail Bruce Kubu from PERF at (202) 454-8308, bkubu@policeforum.org. If you have general project-related questions, please call or email Lorie Fridell from the University of South Florida at (813) 974-6862, lfridell@cas.usf.edu.
- Please do not leave any items blank.
- Please use either blue or black ink and print as neatly as possibly using only CAPITAL letters.
- Please use one of three methods to respond to this survey. If at all possible, we prefer that you use the Internet method as it reduces our data entry time and promotes accuracy. If completing the survey online, please make sure to enter your ID NUMBER, which is located at the top right of this page. Without the ID NUMBER, you will not be able to complete the survey online.
  - An electronic version of this questionnaire is located on the Internet at: http://survey.policeforum.org/uofsurvey.pdf
  - Fax the completed survey to the Police Executive Research Forum at (202) 466-7826.
  - Mail the completed survey to:

    Bruce Kubu - Use of Force Survey
    Police Executive Research Forum
    1120 Connecticut Ave., NW
    Suite 930
    Washington, DC 20036
- Please retain a copy of the completed survey for your records as project staff may call to clarify responses.

Respondent Contact Information:

Title

Last Name

First Name

Email Address

Telephone ( ) - **Ext.**

ID NUMBER

Use of Force Survey

WEAPONS DEPLOYMENT

1. **For each of the less-lethal weapons listed below, please indicate the percentage of uniformed patrol officers/deputies and supervisors assigned to respond to calls for service that routinely carry this less-lethal weapon either on their persons or in their vehicles. Mark either "Less than 50%" or "50% or greater" and then indicate whether most carry the weapon on their persons or in their vehicles. Lastly, place a mark in the final column if your department had this weapon in use in the year 2000.**

Less lethal weapon	Not applicable (this type of weapon is not carried)	If carried by uniformed patrol officers/deputies and supervisors				Mark (■) if your department had this weapon in use in the year 2000
		Indicate whether < 50% or > 50% carry this weapon (mark only one)		Indicate whether most carry this weapon on their persons or in their vehicles (mark only one)		
		Less than 50%	50% or greater	On their persons	In their vehicles	
Straight or side-handle baton	☐	☐	☐	☐	☐	☐
Expandable baton (e.g., Asp)	☐	☐	☐	☐	☐	☐
Conducted energy device (e.g., Taser, Stinger, stun gun)	☐	☐	☐	☐	☐	☐
Personal issue (i.e., handheld) chemical agents (e.g., OC, CS)	☐	☐	☐	☐	☐	☐
Weapon-deployed chemical agent (e.g., pepper ball)	☐	☐	☐	☐	☐	☐
Other impact munitions (e.g., soft projectiles, rubber bullets, bean bags)	☐	☐	☐	☐	☐	☐
Other (please specify):	☐	☐	☐	☐	☐	☐
Other (please specify):	☐	☐	☐	☐	☐	☐

Use of Force Survey

ID NUMBER

FORCE POLICIES

2. Do you use a use of force continuum/model in policy or training?

☐ No → **If NO, please explain:**

☐ Yes → **If YES, please indicate which one of the following BEST describes your continuum or model:**

- ☐ Linear
- ☐ Matrix
- ☐ Circular
- ☐ Other (please describe):

Optional Comments:

3. There is flux in the field of law enforcement with regard to the use of continua/models and the type of continua/models adopted. Please indicate below whether your department has changed in this regard during the last two years OR is contemplating such a change.

- ☐ Our use of a continuum/model or type used has changed in the last two years
- ☐ We are in the process of reconsidering our use of the continuum/model and/or the type used
- ☐ Our agency has not changed in the last two years and is not now considering change

Optional Comments:

4. Are your officers/deputies required to experience the effects of chemical sprays or the conducted energy devices (CED), such as Taser, before they are authorized to carry them? Please mark (■) one answer in each row.

Chemical spray	☐ Yes	☐ No	☐ Not applicable (weapon not deployed)
Conducted energy device (CED)	☐ Yes	☐ No	☐ Not applicable (weapon not deployed)

5. For each of the following scenarios (Scenarios A through E), indicate whether your department would consider each use of force option provided in the table as a reasonable *initial* response to the suspect's resistance based on training standards and/or use of force policy. For each of the scenarios, please assume the following facts:

The following scenarios take place during a traffic stop for a minor moving violation during daylight hours. After stopping the vehicle and conducting a routine warrant check on the driver, the officer learns that the driver is wanted on a warrant for a misdemeanor-level, criminal domestic violence offense. The suspect is a 25 year-old male who is 5'9" tall and weighs 160 lbs. He is of average strength and fitness and has never before been arrested. The officer seeking to make the arrest is also a male and is of similar size, age, and fitness. When the following arrest scenarios take place, the suspect is standing next to his car, and the officer is by himself. Backup is responding but is 10 minutes away and no other citizens are present at the scene.

SCENARIO A

When told by the officer that he is under arrest, the suspect sits down on the ground, hands clearly visible. He silently refuses repeated commands to get up or to place his hands behind his back. His only statement to the officer is "I don't want to go to jail." Which of the following less-lethal options would be authorized under your department's policy or training standards as an *initial* response to the suspect's actions? Please mark either "Yes" or "No" for each force option. If neither policy nor training cover the use of force type in the given scenario, please mark "No policy." If the type of force is not used by your department mark "Force option not utilized by department." Please mark (■) only one answer for each force category.

Less-lethal force authorized

Less-lethal force	Yes	No	No policy	Force option not utilized by department
Soft empty-hand tactics/control	☐	☐	☐	☐
Hard empty-hand tactics/strikes/punches	☐	☐	☐	☐
OC spray, foam, or other chemical weapons	☐	☐	☐	☐
Baton (collapsible, straight, side handle, etc.)	☐	☐	☐	☐
CED in probe mode	☐	☐	☐	☐
CED in drive stun mode	☐	☐	☐	☐

5. For each of the following scenarios (Scenarios A through E), indicate whether your department would consider each use of force option provided in the table as a reasonable *initial* response to the suspect's resistance based on training standards and/or use of force policy. For each of the scenarios, please assume the following facts:

The following scenarios take place during a traffic stop for a minor moving violation during daylight hours. After stopping the vehicle and conducting a routine warrant check on the driver, the officer learns that the driver is wanted on a warrant for a misdemeanor-level, criminal domestic violence offense. The suspect is a 25 year-old male who is 5'9" tall and weighs 160 lbs. He is of average strength and fitness and has never before been arrested. The officer seeking to make the arrest is also a male and is of similar size, age, and fitness. When the following arrest scenarios take place, the suspect is standing next to his car, and the officer is by himself. Backup is responding but is 10 minutes away and no other citizens are present at the scene.

SCENARIO A

When told by the officer that he is under arrest, the suspect sits down on the ground, hands clearly visible. He silently refuses repeated commands to get up or to place his hands behind his back. His only statement to the officer is "I don't want to go to jail." Which of the following less-lethal options would be authorized under your department's policy or training standards as an *initial* response to the suspect's actions? Please mark either "Yes" or "No" for each force option. If neither policy nor training cover the use of force type in the given scenario, please mark "No policy." If the type of force is not used by your department mark "Force option not utilized by department." Please mark (■) only one answer for each force category.

Less-lethal force authorized

Less-lethal force	Yes	No	No policy	Force option not utilized by department
Soft empty-hand tactics/control	☐	☐	☐	☐
Hard empty-hand tactics/strikes/punches	☐	☐	☐	☐
OC spray, foam, or other chemical weapons	☐	☐	☐	☐
Baton (collapsible, straight, side handle, etc.)	☐	☐	☐	☐
CED in probe mode	☐	☐	☐	☐
CED in drive stun mode	☐	☐	☐	☐

ID NUMBER

Use of Force Survey

SCENARIO D

When told by the officer that he is under arrest, the suspect states "I'm not going to jail" and faces off against the officer with his hands raised in a "boxer's stance." Which of the following less-lethal options would be authorized under your department's policy or training standards as an *initial* response to the suspect's actions? Please mark either "Yes" or "No" for each force option. If neither policy nor training cover the use of force type in the given scenario, please mark "No policy." If the type of force is not used by your department mark "Force option not utilized by department." Please mark (■) only one answer for each force category.

Less-lethal force authorized

Less-lethal force	Yes	No	No policy	Force option not utilized by department
Soft empty-hand tactics/control	☐	☐	☐	☐
Hard empty-hand tactics/strikes/punches	☐	☐	☐	☐
OC spray, foam, or other chemical weapons	☐	☐	☐	☐
Baton (collapsible, straight, side handle, etc.)	☐	☐	☐	☐
CED in probe mode	☐	☐	☐	☐
CED in drive stun mode	☐	☐	☐	☐

SCENARIO E

When told by the officer that he is under arrest, the suspect swings at the officer's head with a closed fist. The officer dodges the blow and backs away, but the suspect continues to advance toward him with his fist raised. Which of the following less-lethal options would be authorized under your department's policy or training standards as an *initial* response to the suspect's actions? Please mark either "Yes" or "No" for each force option. If neither policy nor training cover the use of force type in the given scenario, please mark "No policy." If the type of force is not used by your department mark "Force option not utilized by department." Please mark (■) only one answer for each force category.

Less-lethal force authorized

Less-lethal force	Yes	No	No policy	Force option not utilized by department
Soft empty-hand tactics/control	☐	☐	☐	☐
Hard empty-hand tactics/strikes/punches	☐	☐	☐	☐
OC spray, foam, or other chemical weapons	☐	☐	☐	☐
Baton (collapsible, straight, side handle, etc.)	☐	☐	☐	☐
CED in probe mode	☐	☐	☐	☐
CED in drive stun mode	☐	☐	☐	☐

ID NUMBER

Use of Force Survey

TRAINING

Academy and Pre-Service Training

These questions refer to the training provided to recruits who have not previously served in a sworn law enforcement capacity. We use "Academy Training" to refer to the basic training that recruits receive in order to become full-time, sworn employees.

We use "Pre-Service Training" to refer to additional (post-academy) training to new officers/deputies who received academy training outside of the department. That is, some departments that do not provide their own academy training (for instance, if recruits are trained at regional facilities), provide additional training to the recruits following the academy. Generally, the purpose of this "Pre-Service Training" is to train the recruit in department-specific policies and procedures.

6. **What was the total number of training hours that your most recent class of recruits received? Sum the hours of basic academy and pre-service (if any) training —not including field training. (If your recruits receive academy training from more than one provider, use the lowest total hours from among the multiple providers.)**

   ☐☐☐☐ **Training hours**

7. **During the last academy training class, how many hours were spent on the following topics? Include scenario-based training.**

Topic	Hours
Firearms skills	☐☐☐
Self-defense, arrest/control tactics	☐☐☐
Use of less-lethal weapons	☐☐☐
Any scenario-based use of force training not included in the hours provided above	☐☐☐

ID NUMBER

Use of Force Survey

In-Service Training

We use "in-service training" to refer to training provided to active-duty, certified officers/deputies.

8. Which of the following types of instruction have been provided to some or all full-time sworn, line-level officers/deputies during the last two years? We understand that these titles may not match your course titles, the list is not comprehensive, and some topics overlap. Please mark (■) one response for each topic.

Topic	In-service training	
	Provided	Not provided
Physical combat skills (e.g., defensive tactics)	☐	☐
Arrest and control tactics	☐	☐
Mediation skills/conflict management	☐	☐
Use of conducted energy devices	☐	☐
Use of other less-lethal weapons	☐	☐
De-escalation and defusing techniques	☐	☐
Use of deadly force (excluding qualification)	☐	☐
Officer survival	☐	☐
Dealing with citizens with mental illness	☐	☐

9. For which of the following training topics has in-service training been mandatory for all full-time sworn, line-level officers/deputies AND for which topics is it not mandatory for these personnel? Again, these titles may not match your course titles, the list is not comprehensive, and some topics overlap. Please mark (■) one response for each topic.

Topic	In-service training	
	Mandatory for all sworn line-level	Not mandatory for all sworn line-level
Physical combat skills (e.g., defensive tactics)	☐	☐
Arrest and control tactics	☐	☐
Mediation skills/conflict management	☐	☐
Use of conducted energy devices	☐	☐
Use of other less-lethal weapons	☐	☐
De-escalation and defusing techniques	☐	☐
Use of deadly force (excluding qualification)	☐	☐
Officer survival	☐	☐
Dealing with citizens with mental illness	☐	☐

ID NUMBER

Use of Force Survey

FORCE REPORTING/REVIEW

10. Please indicate your department's policy regarding the submission of documentation of the various types of force listed below. That is, for each, indicate whether the documentation of use of force is mandatory or not mandatory. If your department does not permit the use of the type of force listed, please mark "Use of force option not utilized by department." Please mark (■) only one answer per type of force.

Type of force	Mandatory	Not mandatory	Use of force option not utilized by department
Chemical agents (e.g., OC, CS)	☐	☐	☐
Baton strikes with injury	☐	☐	☐
Baton strikes without injury	☐	☐	☐
CED in probe mode	☐	☐	☐
CED in drive stun mode	☐	☐	☐
CED presented, arced or laser pointed (without activation)	☐	☐	☐
Other impact devices (e.g., projectile or non-projectile)	☐	☐	☐
Bodily force resulting in injury or claim of injury (e.g., hitting, striking, kicking or punching)	☐	☐	☐
Bodily force not resulting in injury or claim of injury	☐	☐	☐
Neck restraint/unconsciousness-rendering hold	☐	☐	☐
Canine bites	☐	☐	☐
Vehicle ramming	☐	☐	☐
Firearms discharge at vehicles that hit	☐	☐	☐
Firearms discharge at vehicles that miss	☐	☐	☐
Pointing weapon at individual	☐	☐	☐

11. Who generally completes the mandated reports referenced above? Please mark (■) all that apply.

☐ Officer/deputy

☐ First-line supervisor

☐ Other (please specify):

☐ Not applicable, no reports are mandatory

Use of Force Survey

12. For each of the following types of force listed, please indicate the highest level at which these incidents would normally be reviewed for justification if no injury to the subject occurs. Please mark (■) only one answer per type of force.

	Highest level of review if no injury occurs			
Type of Force	**Not reviewed**	**First-line supervisor**	**Command level**	**Chief or Sheriff**
Chemical spray	☐	☐	☐	☐
Baton strikes	☐	☐	☐	☐
Conducted energy device (CED)	☐	☐	☐	☐
Intentional firearms discharge at a person that did not hit	☐	☐	☐	☐

13. Do you have a use of force report/form that is separate from the standard incident report/form?

☐ No; Skip to Question 14

☐ Yes

If YES, is the information contained in your use of force report/documentation tracked/captured in an electronic database?

☐ No

☐ Yes → **If YES, how long have these data been collected in an electronic database?**

☐☐ **Year(s)**

FORCE INCIDENTS AND OUTCOMES

14. Some departments measure and report their use of force using *"incidents"* as the unit of analysis. For instance, for baton use during a specified period, "10" would indicate 10 incidents or situations in which the baton was used even if multiple officers/deputies used their batons in each of the 10 incidents. Other departments measure and report force with *"officer uses"* as the unit of analysis. For instance, for baton use, "10" would indicate 10 officers/deputies used the baton during the specified period. Some of those officers/deputies may have used the baton in the same incident or situation. Some departments collect their data in a way that can produce information on both number of incidents/situations or number of officers/deputies.

Can your department report amounts of force used in terms of incidents, officer/deputy uses or both?

☐ Incidents ONLY

☐ Officer/deputy uses ONLY

☐ BOTH incidents and officer/deputy uses

Use of Force Survey

ID NUMBER

15. For each type of force listed below, please record the total number of incidents or officer/deputy uses within your department during 2005. Please enter "0" for none, check "no data" if this information is not recorded/tracked, or check "Use of force option not utilized by department" if the force is not used/allowed. Provide only one entry per row.

Information below is measured in:

- ☐ Incidents
- ☐ Officer/deputy uses
- ☐ Other (please specify):

Type of force	Number of incidents or uses	No data	Use of force option not utilized by department
Civilians shot and killed		☐	☐
Civilians shot and wounded but not killed		☐	☐
Civilians shot at but not hit		☐	☐
CED (e.g., Taser, stun gun)		☐	☐
Chemical agents (e.g., OC, CS)		☐	☐
Batons		☐	☐
Other impact devices (e.g., projectile or non-projectile)		☐	☐
Flashlight		☐	☐
Empty hand tactics/control; takedown maneuvers; strikes, punches, kicks		☐	☐
Pointing weapon at individual		☐	☐
Neck restraint/unconsciousness-rendering hold		☐	☐
Canine bites		☐	☐
Vehicle ramming		☐	☐

16. Please indicate below the total number of citizen-generated complaints and internally-generated complaints filed against employees of your department in 2003, 2004, and 2005 for excessive/undue/unnecessary use of force (including use of weapons, tools and tactics, etc.).

	Complaints of excessive, undue, unnecessary force	
	Citizen generated	Internally generated
2003		
2004		
2005		

Use of Force Survey

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17. For the years 2003 through 2005, how many subjects died as a result of officer-involved shootings?

2003 ☐☐☐

2004 ☐☐☐

2005 ☐☐☐

18. Excluding the fatally shot subjects in your response above (Question 17), how many other subjects died after an officer-involved use of force incident during the same years? (Referencing a death below does not necessarily imply that the force caused the death.)

2003 ☐☐☐

2004 ☐☐☐

2005 ☐☐☐

19. Do you collect information on officer and/or subject injuries in an electronic database? (It might be a stand-alone database or, more likely, the injury data are contained with other information in, for instance, a use of force database.)

☐ No; Skip to Question 21

☐ Yes

20. Departments measure "injuries" in various ways. Please indicate below whether your department could produce annual totals for the following ways of measuring injuries to subjects or officers/deputies. Please mark (■) all that apply for each column.

Ways to define/measure "injuries"	Indicate Y (Yes) or N (No) whether your department could produce annual injury totals using this measure	
	Officer/deputy injuries	Subject injuries
Injury	☐ N ☐ Y	☐ N ☐ Y
Visible injury	☐ N ☐ Y	☐ N ☐ Y
Complaint of injury	☐ N ☐ Y	☐ N ☐ Y
No injury complained of or observed	☐ N ☐ Y	☐ N ☐ Y
Death or serious bodily injury	☐ N ☐ Y	☐ N ☐ Y
Other (please specify):	☐ N ☐ Y	☐ N ☐ Y
Other (please specify):	☐ N ☐ Y	☐ N ☐ Y
None of the above (i.e., injuries are not counted)	☐ N ☐ Y	☐ N ☐ Y

Use of Force Survey

21. Indicate below the number of officers/deputies and subjects injured during use of force incidents for 2003, 2004, and 2005.

	Officers/deputies injured	Subjects injured
2003		
2004		
2005		

CONDUCTED ENERGY DEVICES (CED)

22. SCREENER QUESTION: Has your department deployed any form of CED (e.g., Tasers) to any sworn personnel?

- ☐ No; Skip to Question 39
- ☐ Yes

23. Indicate below the year that you (a) first placed a CED on the street, (b) provided CEDs to patrol supervisors, (c) provided CEDs to some or all patrol officers/deputies, and (d) provided CEDs to one or more special units. Some dates may be the same. If you did not engage in the deployment activity, please mark "Not applicable."

Department activity related to CED deployment	Year	Not applicable
(a) First placed a CED on the street		☐ NA
(b) Provided CEDs to patrol supervisors		☐ NA
(c) Provided CEDs to some or all patrol officers/deputies		☐ NA
(d) Provided CEDs to one or more special units		☐ NA

Use of Force Survey

24. Which of the following types of CEDs are routinely deployed to the following categories of personnel in your department? Please mark (■) all that apply for each row. If you do not have the group specified at top, please mark the row labeled "No such unit/group."

Type of CED	Patrol officers/ deputies	Patrol supervisors	Investigators	Special operations units (e.g., SWAT)	School resource officers/ deputies	Other specialized units (e.g., gang unit)
Taser (e.g., M26, X26)	☐	☐	☐	☐	☐	☐
Other (please specify):	☐	☐	☐	☐	☐	☐
CEDs not routinely deployed to this group	☐	☐	☐	☐	☐	☐
No such unit/ group	☐	☐	☐	☐	☐	☐

25. What is the minimum number of training hours officers/deputies must receive before they are permitted to carry a CED?

☐☐☐ **Hours**

26. Does this training exceed the training required/recommended by the manufacturer?

☐ No

☐ Yes → **If yes, how much time is spent on this training beyond that required/recommended by the manufacturer?**

☐☐☐ **Hours**

27. Indicate whether officers/deputies must successfully complete a written exam and/or a practical exam following initial training before they are permitted to carry a CED.

Written Examination ☐ No ☐ Yes

Practical Examination ☐ No ☐ Yes

28. Do you train your officers/deputies on the topic of Excited Delirium?

☐ No

☐ Yes

29. How often are officers/deputies who carry CEDs required to undergo retraining following their initial training?

☐ Never (officers/deputies need not be retrained); Skip to Question 31

☐ Every year

☐ Every two years

☐ Every three years

☐ Other (please specify):

30. What are the number of hours required for this recertification/retraining referenced in the question above (Question 29)?

☐☐☐ **Hours**

31. Which statement describes your department's policy governing CED deployment? Please mark (■) all that apply.

- ☐ My department has a stand-alone CED policy
- ☐ My department has CED-specific language in its general use of force policy
- ☐ My department does not mention CEDs in policy
- ☐ Other (please specify):

32. Based on your policy and/or training, please RANK the following force types from 1 to highest, with 1 indicating the lowest level of force and the highest number indicating the most elevated level of force. ***Please note that more than one type of force can have the same force ranking if they are believed to represent the same level of force. Also note that departments will vary in terms of their highest number (for instance, 3, 6, 8). Use consecutive numbers.*** **If your department does not utilize a particular type of force, please fill that box in with an "NA."**

As an example a department might give verbal control commands a rank of "1"; give Chemical incapacitants, Control holds and Strikes/punches ranks of "2"; give CEDs, Batons/impact weapons, Chemical/kinetic hybrids, and Kinetic weapons or munitions ranks of "3"; Firearms a rank of "4"; and Incapacitating holds an "NA."

Type of force	Rank 1=Low
Verbal control commands	☐☐
Chemical incapacitants (e.g., OC, CS)	☐☐
CED (e.g., Taser)	☐☐
Control holds (e.g., escort, pain-compliance holds)	☐☐
Strikes/punches	☐☐
Baton/impact weapons	☐☐
Chemical/kinetic hybrids (e.g., pepper filled projectiles)	☐☐
Kinetic weapons or munitions (e.g., beanbag projectile)	☐☐
Incapacitation holds (e.g., neck restraints)	☐☐
Firearms	☐☐

Use of Force Survey

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33. Has your CED policy and/or placement of the CED on your use of force continuum/model changed since January 2003?

- ☐ No
- ☐ Yes, the change expanded the circumstances in which officers/deputies could use the CED
- ☐ Yes, the change reduced the circumstances in which officers/deputies could use the CED
- ☐ Not applicable (for instance, the department does not reference CEDs in policy or on a use of force continuum/model; department did not have CEDs in January 2003)

34. Some department policies, procedures, and/or training prohibit in all circumstances the use of CEDs against certain populations or in certain circumstances. Other department policies, procedures, and/or training indicate in some manner that such use is *generally* not allowed, but is allowable if necessary and/or special circumstances exist. Still others do not set forth any specific restrictions on these populations/circumstances. For each population and/or circumstance listed below, indicate whether *your department's policy, procedures and/or training* on CED use in PROBE MODE (1) prohibit CED use in all circumstances, (2) restrict use except when necessary and/or when special circumstances exist, or (3) have no restriction set forth in policy, procedure and/or training. Please (■) mark one choice for each population/circumstance.

Population/circumstance	Prohibits in all circumstances	Restricts use except necessary, special circumstances	No restriction set forth in policy, procedure, training
Driver of moving vehicle	☐	☐	☐
Person in elevated area (e.g., on bridge, in tree)	☐	☐	☐
Youth/age	☐	☐	☐
Youth/size	☐	☐	☐
Elderly	☐	☐	☐
Handcuffed suspect	☐	☐	☐
Person around flammable substances	☐	☐	☐
Person in/around water	☐	☐	☐
Subject threatening deadly force	☐	☐	☐
Person fleeing on foot	☐	☐	☐
Known or apparent cardiac condition	☐	☐	☐
Apparently pregnant woman	☐	☐	☐
Apparently physically disabled person	☐	☐	☐
Person who seems in Excited Delirium	☐	☐	☐
Emotionally disturbed person	☐	☐	☐

Use of Force Survey

ID NUMBER

35. Select the statement below that BEST describes whether and how your department's policies, procedures and/or training distinguish between CED use in PROBE versus DRIVE STUN mode.

- ☐ Parameters on the use of probe mode and drive stun mode are the same
- ☐ There are more restrictions on drive stun mode than on probe mode
- ☐ There are more restrictions on probe mode than on drive stun mode

36. Does your department's policies, procedures or training restrict the number of activations that can be administered to a subject, the length in seconds of each activation and/or the total time a person can be under CED activation? If you respond YES to any listing, please provide the relevant number in the column at the right.

Restriction in policy, procedures, training	No	Yes	If YES, please provide the number:
Policy restricts total number of activations that can be administered	☐	☐	☐☐☐
Policy restricts length in seconds of activations	☐	☐	☐☐☐
Policy restricts the total time a person can be under CED activation	☐	☐	☐☐☐

37. Do you have separate forms for documenting CED use?

- ☐ No; Skip to Question 39
- ☐ Yes

38. Do you record officer/deputy and/or subject injury information on your CED report?

- ☐ No
- ☐ Yes

DOCUMENT SUBMISSION

39. It would be very helpful to the project if we received from our responding departments copies of various documents related to our topic. Please mail or email the following to Bruce Kubu:

a) Your major use of force policy
b) Your CED-specific policy, if you have one
c) A copy of your use of force continuum/model/matrix, if you have one
d) Your general use of force reporting form, if you have one
e) Your CED reporting form, if you have one

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Police Executive Research Forum
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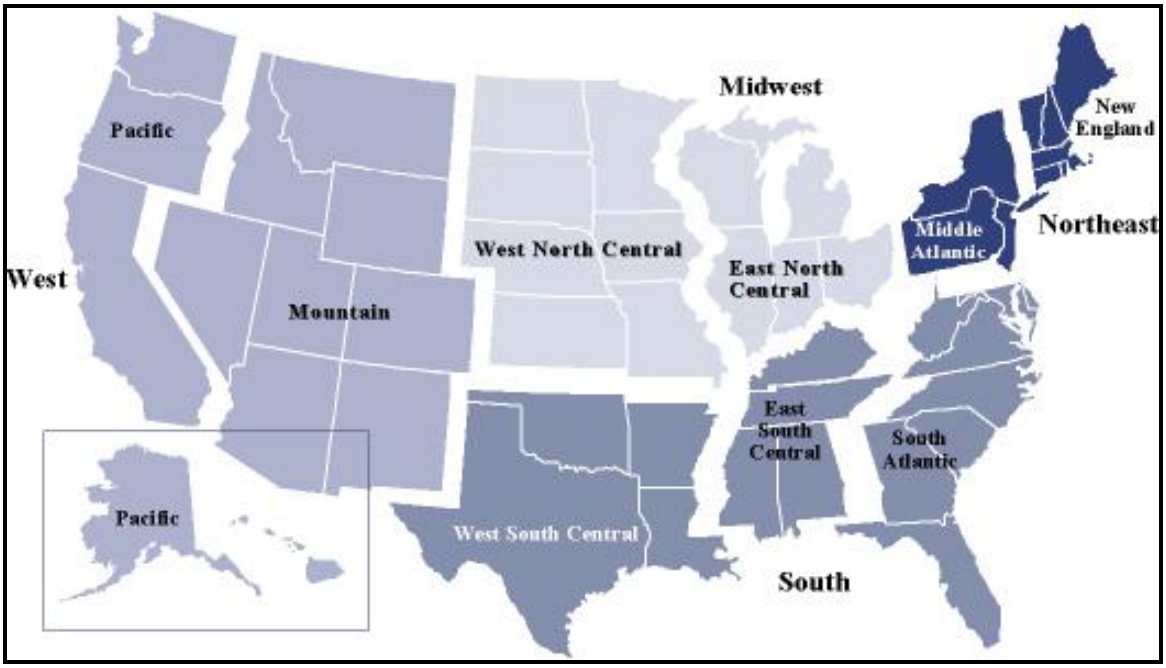
Washington, DC 20036

Thank you for your assistance with this important survey!

APPENDIX C

Four Regions of the U.S. per the U.S. Census Bureau *



*Note:

- The Northeast region contains the New England and Middle Atlantic subdivisions.
- The Midwest region contains the East North Central and West North Central subdivisions.
- The South region contains the West South Central, East South Central and South Atlantic subdivisions.
- The West region contains the Mountain and Pacific subdivisions.

Classification of States into Four Census Regions

Region 1 Northeast	Region 2 Midwest	Region 3 South	Region 4 West
Connecticut	Iowa	Alabama	Alaska
Massachusetts	Illinois	Arkansas	Arizona
Maine	Indiana	Delaware	California
New Hampshire	Kansas	Florida	Colorado
New Jersey	Michigan	Georgia	Hawaii
New York	Minnesota	Kentucky	Idaho
Pennsylvania	Missouri	Louisiana	Montana
Rhode Island	North Dakota	Maryland	New Mexico
Vermont	Nebraska	Mississippi	Nevada
	Ohio	North Carolina	Oregon
	South Dakota	Oklahoma	Utah
	Wisconsin	South Carolina	Washington
		Tennessee	Wyoming
		Texas	
		Virginia	
		West Virginia	
		Washington, DC	

APPENDIX D

Sample Selected with Percentages by Population Strata: Population Served, Region, and Department Type.

Population Served	Region	Department Type	Pop. Count	Sample Count	Within Stratum, % of Popula-tion Selected	% of TOTAL Sample within Stratum
Missing	Northeast	State Police	9	9	100.0%	0.9%
		County/Municipal Police	103	23	22.3%	2.3%
		City/County/Other Sheriffs				
	Midwest	State Police	12	12	100.0%	1.2%
		County/Municipal Police	339	23	6.8%	2.3%
		City/County/Other Sheriffs				
	South	State Police	16	16	100.0%	1.6%
		County/Municipal Police	278	23	8.3%	2.3%
		City/County/Other Sheriffs				
	West	State Police	13	13	100.0%	1.3%
		County/Municipal Police	25	23	92.0%	2.3%
		City/County/Other Sheriffs				
Under 10,000	Northeast	County/Municipal Police	1660	23	1.4%	2.3%
		City/County/Other Sheriffs	6	6	100.0%	0.6%
	Midwest	County/Municipal Police	3231	23	0.7%	2.3%
		City/County/Other Sheriffs	287	23	8.0%	2.3%
	South	County/Municipal Police	3001	23	0.8%	2.3%
		City/County/Other Sheriffs	208	23	11.1%	2.3%
	West	County/Municipal Police	744	23	3.1%	2.3%
		City/County/Other Sheriffs	127	23	18.1%	2.3%

Population Served	Region	Department Type	Pop. Count	Sample Count	Within Stratum, % of Popula-tion Selected	% of TOTAL Sample within Stratum
10,000 to 49,999	Northeast	County/Municipal Police	918	23	2.5%	2.3%
		City/County/Other Sheriffs	51	22	43.1%	2.2%
	Midwest	County/Municipal Police	832	23	2.8%	2.3%
		City/County/Other Sheriffs	536	23	4.3%	2.3%
	South	County/Municipal Police	743	23	3.1%	2.3%
		City/County/Other Sheriffs	805	23	2.9%	2.3%
	West	County/Municipal Police	346	23	6.6%	2.3%
		City/County/Other Sheriffs	151	23	15.2%	2.3%
50,000 to 99,999	Northeast	County/Municipal Police	97	22	22.7%	2.2%
		City/County/Other Sheriffs	46	22	47.8%	2.2%
	Midwest	County/Municipal Police	118	23	19.5%	2.3%
		City/County/Other Sheriffs	102	23	22.5%	2.3%
	South	County/Municipal Police	110	23	20.9%	2.3%
		City/County/Other Sheriffs	199	23	11.6%	2.3%
	West	County/Municipal Police	119	23	19.3%	2.3%
		City/County/Other Sheriffs	47	22	46.8%	2.2%

100,000 to 499,999	Northeast	County/Municipal Police	29	22	75.9%	2.2%
		City/County/Other Sheriffs	71	22	31.0%	2.2%
	Midwest	County/Municipal Police	46	22	47.8%	2.2%
		City/County/Other Sheriffs	109	23	21.1%	2.3%
	South	County/Municipal Police	84	22	26.2%	2.2%
		City/County/Other Sheriffs	169	23	13.6%	2.3%
	West	County/Municipal Police	79	21	26.6%	2.1%
		City/County/Other Sheriffs	64	22	34.4%	2.2%
500,000 to 749,999	Northeast	County/Municipal Police	1	1	100.0%	0.1%
		City/County/Other Sheriffs	12	12	100.0%	1.2%
	Midwest	County/Municipal Police	6	6	100.0%	0.6%
		City/County/Other Sheriffs	8	8	100.0%	0.8%
	South	County/Municipal Police	12	12	100.0%	1.2%
		City/County/Other Sheriffs	12	12	100.0%	1.2%
	West	County/Municipal Police	3	3	100.0%	0.3%
		City/County/Other Sheriffs	10	10	100.0%	1.0%

750,000 to 999,999	Northeast	County/Municipal Police				
		City/County/Other Sheriffs	5	5	100.0%	0.5%
	Midwest	County/Municipal Police				
		City/County/Other Sheriffs	6	6	100.0%	0.6%
	South	County/Municipal Police	4	4	100.0%	0.4%
		City/County/Other Sheriffs	9	9	100.0%	0.9%
	West	County/Municipal Police	3	3	100.0%	0.3%
		City/County/Other Sheriffs	4	4	100.0%	0.4%
1,000,000 or More	Northeast	County/Municipal Police	5	5	100.0%	0.5%
		City/County/Other Sheriffs	8	8	100.0%	0.8%
	Midwest	County/Municipal Police	2	2	100.0%	0.2%
		City/County/Other Sheriffs	6	6	100.0%	0.6%
	South	County/Municipal Police	5	5	100.0%	0.5%
		City/County/Other Sheriffs	8	8	100.0%	0.8%
	West	County/Municipal Police	5	4	80.0%	0.4%
		City/County/Other Sheriffs	8	8	100.0%	0.8%

APPENDIX E

Strata Information Used to Calculate Weights

Population Served	Region	Department Type	(A) Population Count	(B) % of Population (16,027)	(C) Respondent Count	(D) % of Survey Respondents (518)	(E) Weights (B)/(D)
Missing	Northeast	State Police	9	0.056%	5	0.965%	0.0582
		County/Municipal Police	103	0.643%	4	0.772%	0.8323
		City/County/Other Sheriffs					
	Midwest	State Police	12	0.075%	11	2.124%	0.0353
		County/Municipal Police	339	2.115%	7	1.351%	1.5652
		City/County/Other Sheriffs					
	South	State Police	16	0.100%	12	2.317%	0.0431
		County/Municipal Police	278	1.735%	8	1.544%	1.1231
		City/County/Other Sheriffs					
	West	State Police	13	0.081%	11	2.124%	0.0382
		County/Municipal Police	25	0.156%	9	1.737%	0.0898
		City/County/Other Sheriffs					

Under 10,000	Northeast	County/Municipal Police	1660	10.358%	8	1.544%	6.7065
		City/County/Other Sheriffs	6	0.037%	1	0.193%	0.1939
	Midwest	County/Municipal Police	3231	20.160%	11	2.124%	9.4934
		City/County/Other Sheriffs	287	1.791%	7	1.351%	1.3251
	South	County/Municipal Police	3001	18.725%	6	1.158%	16.1656
		City/County/Other Sheriffs	208	1.298%	3	0.579%	2.2409
	West	County/Municipal Police	744	4.642%	9	1.737%	2.6718
		City/County/Other Sheriffs	127	0.792%	8	1.544%	0.5131
10,000 to 49,999	Northeast	County/Municipal Police	918	5.728%	11	2.124%	2.6973
		City/County/Other Sheriffs	51	0.318%	7	1.351%	0.2355
	Midwest	County/Municipal Police	832	5.191%	12	2.317%	2.2409
		City/County/Other Sheriffs	536	3.344%	11	2.124%	1.5749
	South	County/Municipal Police	743	4.636%	17	3.282%	1.4126
		City/County/Other Sheriffs	805	5.023%	4	0.772%	6.5045
	West	County/Municipal Police	346	2.159%	13	2.510%	0.8602
		City/County/Other Sheriffs	151	0.942%	7	1.351%	0.6972

50,000 to 99,999	Northeast	County/Municipal Police	97	0.605%	15	2.896%	0.2090
		City/County/Other Sheriffs	46	0.287%	8	1.544%	0.1858
	Midwest	County/Municipal Police	118	0.736%	17	3.282%	0.2243
		City/County/Other Sheriffs	102	0.636%	12	2.317%	0.2747
	South	County/Municipal Police	110	0.686%	21	4.054%	0.1693
		City/County/Other Sheriffs	199	1.242%	11	2.124%	0.5847
	West	County/Municipal Police	119	0.742%	16	3.089%	0.2404
		City/County/Other Sheriffs	47	0.293%	15	2.896%	0.1013
100,000 to 499,999	Northeast	County/Municipal Police	29	0.181%	17	3.282%	0.0551
		City/County/Other Sheriffs	71	0.443%	6	1.158%	0.3825
	Midwest	County/Municipal Police	46	0.287%	16	3.089%	0.0929
		City/County/Other Sheriffs	109	0.680%	14	2.703%	0.2516
	South	County/Municipal Police	84	0.524%	17	3.282%	0.1597
		City/County/Other Sheriffs	169	1.054%	10	1.931%	0.5462
	West	County/Municipal Police	79	0.493%	19	3.668%	0.1344
		City/County/Other Sheriffs	64	0.399%	15	2.896%	0.1379

500,000 to 749,999	Northeast	County/Municipal Police	1	0.006%	1	0.193%	0.0323
		City/County/Other Sheriffs	12	0.075%	1	0.193%	0.3878
	Midwest	County/Municipal Police	6	0.037%	2	0.386%	0.0970
		City/County/Other Sheriffs	8	0.050%	3	0.579%	0.0862
	South	County/Municipal Police	12	0.075%	11	2.124%	0.0353
		City/County/Other Sheriffs	12	0.075%	8	1.544%	0.0485
	West	County/Municipal Police	3	0.019%	3	0.579%	0.0323
		City/County/Other Sheriffs	10	0.062%	7	1.351%	0.0462
750,000 to 999,999	Northeast	County/Municipal Police					
		City/County/Other Sheriffs	5	0.031%	3	0.579%	0.0539
	Midwest	County/Municipal Police					
		City/County/Other Sheriffs	6	0.037%	3	0.579%	0.0646
	South	County/Municipal Police	4	0.025%	3	0.579%	0.0431
		City/County/Other Sheriffs	9	0.056%	6	1.158%	0.0485
	West	County/Municipal Police	3	0.019%	3	0.579%	0.0323
		City/County/Other Sheriffs	4	0.025%	4	0.772%	0.0323

1,000,000 or More	Northeast	County/Municipal Police	5	0.031%	3	0.579%	0.0539
		City/County/Other Sheriffs	8	0.050%	1	0.193%	0.2586
	Midwest	County/Municipal Police	2	0.012%	2	0.386%	0.0323
		City/County/Other Sheriffs	6	0.037%	3	0.579%	0.0646
	South	County/Municipal Police	5	0.031%	3	0.579%	0.0539
		City/County/Other Sheriffs	8	0.050%	7	1.351%	0.0369
	West	County/Municipal Police	5	0.031%	5	0.965%	0.0323
		City/County/Other Sheriffs	8	0.050%	5	0.965%	0.0517